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Sudan - the advent of the "donkey" pump

Concomitant with the drought in West and East Africa, a country between both these parts of the continent in 1972 was just emerging from a state of protracted and bloody civil war. This was Sudan, where in the South for seventeen years the partly Christian population of the Bahr-el-Ghazal, Upper Nile and Equatoria Provinces had been fighting the Arab-speaking Sudanese of the North, including the central government in Khartoum.

When the war ended, the South was left with hundreds of thousands dead. Hundreds of thousands more had taken refuge in neighbouring countries, the Central African Republic, Zaire, Uganda and Kenya. Villages were burned and razed. Water wells were destroyed. Some the wells had had corpses thrown into them. After the cessation of hostilities a trickle of returning refugees was seeking its way to the old home grounds. In the centres of Juba, Wau and Malakal, a new local semi-autonomous government was trying to bring a semblance of order into the chaos of destruction.

Such was the situation, when the Norwegian government allocated two million dollars for water supply in Southern Sudan. This was the effect of a UNICEF fundraising action described in a previous chapter. After the initial discussions between Fuad Kronfol, then UNICEF Representative in Khartoum, the central government, and Martin Beyer from New York it led to the assignment of the Norwegian consultant Per-Fredrik Tröften, inventor of the method of horizontal drilling for the "revitalization" of water wells in India and jointly with Jan-Erik Persson of Sweden, of an ingenious handpump, the "PETRO-pump".

Tröften's recommendations led to the drafting of a programme for Upper Nile Province, centered on Juba, for the drilling of wells and installation of handpumps in hundreds of villages. An additional and then novel feature was the close co-operation and standardization of drilling material with the Norwegian Church Aid (Norsk Kirkehjelp). Through their mission station at Torit, some 100 miles east of Juba, the Norwegians for many years had run a rural development cum road construction programme in the remote southeastern corner of southern Sudan.

That co-operation became a shade less intensive, when just before the beginning of the implementation, the Sudanese government requested UNICEF to leave Juba aside and instead concentrate on Bahr-el-Ghazal Province further west, working out of its capital, Wau. The first UNICEF project manager, the Norwegian drilling engineer Per Engebak and his team, faced an unusual challenge. The nearest port was Port Sudan, connected to Wau via Khartoum and El Obeid through a rickety railroad. It could take a month or more to get the goods through - a distance of over 2,500 kilometres. The other port was Mombasa in Kenya - which meant truck transport over about the same distance and leading through Idi Amin's Uganda.

Undaunted, Engebak and his companions from UNICEF, the Philippine Chief Mechanical Engineer, Max Madayag, the Nepali Administrative Officer Bijaya Mallapathy, and the young Canadian mathematician Wayne Hooks, in 1976 set to their task. While waiting for the trucks to arrive, they had maintenance workshops, offices and laboratories constructed on the outskirts of Wau.

The drilling equipment arrived and so did the handpumps. The priority was given to the hardrock areas in the southern part of Bahr-el-Ghazal. Later these activities spread to adjoining parts of the province of Equatoria. Drilling methods and equipment were the same as those used in India - compressed air rigs with down-the-hole hammers. The handpumps were standard India Mark-II. A small manufacture of these was started up at the workshop in Wau.

For the local population, predominantly of the Dinka tribe, the handpumps were completely new and rapidly gained popularity, being referred to as the "donkey pump". The Dinkas are stately, tall people. The men - very appropriately in the hot climate - walk about practically naked. All men at any given moment carry three or four light and short iron-tipped spears for hunting and for fighting. Before the greater spread of handpumps (to 1985 some 800 installed in Bahr-el-Ghazal alone), the Dinka used to fight each other with the spears, often seriously wounding each other in the fray. A visit to the government hospital in Gogriel, 100 kms. north of Wau in 1976 revealed that 90 out of the 100 hospital beds were occupied by young and old men with bad cuts and gashes from fights, often over cattle and women, but mainly over water.

During the peaceful ten years before the resurgence of the Anya-Anya rebellion, this incidence of epidemic spear wounds rapidly diminished with the introduction of handpumps village by village, until in many places the fighting was discontinued and the hospital beds could be used for the really necessary treatment of more "normal" sick cases.

An even greater novelty was the training of handpump caretakers, selected from each village with a new handpump. The caretakers-elect were brought together at central locations in their own districts in order to undergo a condensed course in handpump mechanics and repairs with a considerable amount of health education. This training was bestowed upon then by the WHO sanitary engineer - for many years Mr. Singh - coming the 1200 kilometres by jagged road from Juba for these occasions.

The participant villagers were brought to their training courses by truck. It was the first time for most of them to meet and consort with countrymen from other villages, which meant an almost literal instant widening of their horizon. The ambience became quite congenial, culminating in exotic meals on dik-dik (a small antelope) and baboon, reinforced by the local beer.

Again, in this work a major feature was training, human resources development. This was applied to all levels. On the managerial and technical levels, the difficulty was to get the trainees to stay on, once they had learned their tasks and began to become operational. Either they were siphoned off by the government and made Director-Generals, or, if they were water well drillers or mechanics, they would succumb to the lure of the Gulf States, which then were wallowing in their oil riches with an unending appetite for skilled labour.

There were a few who bravely stayed on, such as the Sudanese manager of the project, Joseph Maker (pronounced Makkair) and the hydrogeologist Mohammed El Fatih. In the meantime drillers were trained both locally and in the UN-sponsored school for water technicians at Wad Magboul, near Khartoum under the Philippine drilling engineer Alfredo Tupas, who eventually ended up in Juba as the WHO engineer.

Some years later, around 1978, the UNICEF-assisted water supply activities were spread to another area, roughly halfway between Wau in the South and Khartoum in the North: Southern Kordofan, centered on the town of Kadugli. The first task there was to rehabilitate the large rainwater collection basins, situated in shallow wadis, dry valleys, which during the brief rains would be filled with water. These basins or "hafirs" measure several hundred metres/yards across and serve the needs of humans and their animals. First installed by the British colonial government forty or fifty years earlier, the "hafirs" with their earthen walls arranged in a rectangular plan, had been filled throughout the years with fine silt that had to be cleaned out before they again could be used to collect and store water.

This large and dry savannah landscape is home for semi-nomadic herdsmen, whose main subsistence are the herds of cattle, goats and the occasional camel. The "hafirs" in many places would be the only way to provide water in quantity. In order to desilt the "hafirs", UNICEF had to enter into the procurement of earthmoving machinery such as bulldozers and draglines, a far cry from bedpans and baby scales. It was a most unusual approach and caused occasional visitors, who had not seen the normal range of UNICEF-assisted projects, to raise an eyebrow. Some of them thought that <u>all</u> UNICEF assistance in the world went into such heavy hardware.

Somewhat later, in the same areas, the first lightweight drill rigs arrived in Southern Kordofan. The "donkey pump" made its inroads there, too, and made it possible for the benefits of safe water supply to reach far-off villages in this desolate landscape. For the first years, the South Kordofan part of the programme was taken care of by Jack Sell, a young engineer from the United States.

As in Ethiopia, the national agency responsible for rural water supply, the National Water Board, provided a solid base for the work. It may not have been very strong in numbers, but was headed and staffed by purposeful national professionals. The drilling crews in the UNICEF-assisted projects in the South were reinforced by experienced engineers and drillers from the Water Board. Also, some more drilling equipment was supplied from Khartoum, especially when the Bahr-el-Ghazal Province activities were expanded to the areas north of Wau in the soft sediments of the Umm Ruwaba formation.

MIDDLE EAST

Yemen Arab Republic - the transition to modern times

Another beginning was made from UNICEF's side, when in 1972 the Federal Republic of Germany allocated US$ 890,000 for rural water supply in the Yemen Arab Republic, the former North Yemen.

A five-year long and violent civil war had ended in 1967 with the ouster of the old ruler, the Imam, who had been the secular and religious head of this mountainous country in the southwestern part of the Arabian peninsula. The Imam had ruled in purely medieval fashion over his inhabitants, not allowing any modernities, except for a DC-3 airplane for himself and one car operating on the few miles of roads that existed in the country. There were only two Yemeni medical doctors, and both were practicing in the United States.

A totally new era was ushered in when the Imam fled through one of the escape tunnels of his towerlike palace-fortress in the city of Taizz, leaving behind him a collection of antiquated radio receivers and a roomful of vials with ambergris (oil of the spermaceti whale), a powerful aphrodisiac.

An intense period of reconciliation and reconstruction followed the end of the civil war. UNICEF could establish modest but significant support to a number of programmes and projects for mother and child health. Part of this was done in co-operation with NGOs such as Swedish Rädda Barnen (Save the Children), who set up children's hospitals in Taizz and El Fatih with young Yemeni medical doctors as interns.

The infrastructure of the country was rapidly improved with the major world powers competing peacefully with one another. Thus the backbone of a national road system, forming a triangle between the Imam's old capital of Taizz in the south, the new capital, Sana'a in the north and the main port city on the Red Sea, Al Hodeida, was established by the Soviet Union, the People's Republic of China and USA with the Federal Republic of Germany each in peaceful competition building their stretch of these important roads.

Water supply was an immediate priority. The cities and larger towns would be taken care of by international and bilateral funding. In the rural areas, though, UNICEF was the first major international organization to be tapped for help. Some limited beginnings were made in the early 1970s, including the provision of a simple piped water scheme with public standposts to the little sleepy town of Al Mukha, the ancient Mocha or Mocca of coffee fame. To visiting UNICEF dignitaries it was known as the place where one could come over a crate of beer, occasionally smuggled into the country through some ship putting ashore, God willing and weather permitting.

By 1974, the government of the Federal Republic of Germany began to become concerned about their funds remaining unspent after two years. The Ministry of Economic Co-operation in Bonn (BMZ) indicated that if nothing happened soon, they might take the money back plus the interest

accrued! This caused UNICEF's then Representative in Sana'a, Toni Beruti, with Martin Beyer to make a rapid survey of the water supply situation in order to see where everyone stood with projects and plans in Yemen and where UNICEF-supported activities could fit in.

What they found was that the Rural Water Supply Agency was willing but totally understaffed. There was the Director-General, Mr. Abdul Bari Sallah, with a few engineers and technicians, supported by an able and interested WHO engineer and a few volunteers. At the other end of Sana'a, USAID had built a sizeable compound with workshop and offices for rural water supply and wanted the government to use that. The government on its side wished to maintain its independence, and so it was the question of how to strengthen its services and at the same time not to perjudicate the strong inputs from USAID and - hopefully - other donors.

One of the main problems was human resources and management. Illustrative of the needs for skills of all kinds to help the young Republic in its crash transition from the 15th to the 20th Century, was the need for as basic a service as secretaries and typists. In its support to the National Institute for Demography, Toni Beruti had included an allocation for training of women as secretaries. It was a most startling sight to behold all these young ladies, completely veiled in black from top to toe, sitting at their typewriters and computers, occasionally peering at you with big dark eyes from a narrow slit near the top of their headgear.

The training of local craftsmen did work out, though. With seriousness and energy, the trenches were dug, pipes laid and pumps installed with their engines. Many of the systems installed would be in the form of engine-powered pumps forcing water up from springs and other water sources in the valleys to the villages. These most frequently are located on the hill and mountain tops, a reminder of thousands of years of warfare, with the rich soils and the old culture being highly attractive to marauding neighbours. Consequently, in many places, water had to be lifted for many hundreds of metres (thousands of feet) from the sources to the users. This caused relatively high costs for the installation, operation and maintenance. It was a somewhat mitigating circumstance that Yemen at least was a neighbour of Saudi Arabia with a secure supply of oil and gasoline produced there.

Management was not easy either. It could happened that local sheikhs entered the Rural Water Supply Division's store in Sana'a, with a group of clansmen, all heavily armed with submachine guns, simply requisitioning a pile of pipes, supplied by UNICEF or some other agency. The storekeepers would not possess equally strong arguments and thus had to relinquish their hoard. The communities of those sheikhs probably needed their water as badly and benefitted as much as any other community, but it would disrupt any orderly plan and delay the action for even needier places.

During the last years of the 1970s and into the 1980s, the responsibility for UNICEF's inputs lay with an Egyptian engineer, Michel Shatby. With the upswing of the economy of the oil-rich Arab countries in the mid-1970s, more funds, equipment and materials were brought in from different donors. This allowed for the widening of the scope of the government's work, in the proud Yemeni tradition of water supply and engineering, symbolized by the ancient Marib dam of the times of the Queen of Sheba.

People's Democratic Republic of Yemen

During the late 1970s some assistance, ably supplemented by two senior UNICEF engineers, was provided to the People's Democratic Republic of Yemen, ("South Yemen"). The water supply needs of the large town-like villages would be filled with water led in by pipes from wells to standposts and house connections. The engineers were R. S. Pandian from India (now in the Yemen Arab Republic) and Wahid Saldeen from Sri Lanka (now in India), training the national engineers in planning, design and supervision. Their work took them to many parts of the country, including the legendary Hadramaut valley with its capital Shibam, full of thousand-year old skyscrapers.

Lebanon - clearing the minefields for water pipes

The well-developed and beautiful land of Lebanon, regarded as an oasis of peace in a strife-torn part of the world, erupted into a civil war in 1975 which still goes on despite attempts to resolve the situation. Reportedly there were up to forty different warring factions, none of which seemed willing or interested to lay down arms or to do away with their explosives. Bombs, gunfights, mortar and artillery fire remained a fact of life.

Families were shattered. Children were killed, maimed, traumatized or would but learn the art of warfare. The physical aspects were those of destruction of homes, hospitals, schools and public utilities. Water supply was curtailed. Holes were shot into water cisterns by trigger-happy bazookaists. Pipelines were cut off. Entire villages and towns were in danger of epidemic diseases for want of water and failing sanitation.

UNICEF's task became one of intense rehabilitation, concentrating in particular on institutions serving children, notably schools and hospitals. Being the only major external aid agency with access to all parts of southern Lebanon, the part of the country most divided, UNICEF had to saddle a responsibility beyond the usual. Realizing this, funding sources such as the United States and Saudi Arabia provided major special contributions in order to enable UNICEF to go on with the work.

This involved water well drilling, carried out by local Lebanese contractors, the installation of entire pumping stations, repair of water treatment facilities and the laying of pipelines and connections to hospitals and schools. It was not without its hazards. At the occasion, help had to be relied upon from the UN peace-keeping forces in order to clear stretches of terrain of land-mines for the laying of pipelines.

Somehow, this work from UNICEF's side evoked a certain restraint on the side of different warring groups. Although they were violently opposed to one another, they would not interfere with the continued functioning of these water supply systems. One case that could be

mentioned as an example of this rare stance, is a piped water supply system across southern-most Lebanon. It originates at wells drilled close to the foot of Mt. Hermon and goes westward towards to the coast, branching out to a number of villages along the way. The water would thus pass through and serve areas held by organizations as diverse as the PFLP, the PLO, the UN Forces and the Christian militia that had been set up by the Lebanese army major Haddad. There would have been any opportunity to cut off the water supply for one another. Yet, the feeling of the sacredness of water, as enunciated in the Holy Koran, prevailed. Sometimes, interruptions did occur. Repairs had to be made after heavy tanks passed over pipelines, inadvertently cracking them up. By and large, though, there was never any hostility towards UNICEF and its water engineers.

These engineers constituted a closely knit, highly skilled and low-key group of expatriates and nationals of Lebanon. The top responsibility throughout the ten years of the management of UNICEF in the emergency of Southern Lebanon (1975-1985) lay in the hands of Gullmar Andersson, one of UNICEF's most experienced emergency co-ordinators. He came to Beirut from the drought and political upheaval of Ethiopia, theretofore Bangladesh and before that, service with the UN troops in the Gaza Strip. With an impressive appearance, Gullmar Andersson combined practicality with great negotiating skills, helped by his Swedish nationality which would enhance a benevolent neutral political position. He quickly became a focal point in the small community of international relief workers, wherever he went. His volleyball court was the gathering point for all of them, where excess calories were worked off and acute problems at the same time could be talked over and resolved. Taking care of children in emergencies lay in the family. Andersson's Norwegian wife Ingrid organized and managed The Norwegian Save the Children (Redd Barna) activities subsequently in Dhaka, Addis Ababa and Beirut.

For the supervision and management of the water and sanitation projects, Gullmar Andersson for many years had at his side the British-born Canadian sanitary engineer, Maurice Porter. Utterly modest, yet highly skilled and in spite of his mild manners, wisely decisive, Maurice Porter directed the rehabilitation of water supply systems in all of southern Lebanon. Early mornings in Beirut he would begin his days by walking the Andersson dogs, the Alsatian Max and the Lhasa Apso, Fredrik, along the Corniche of Beirut. Maurice had retired long before that from WHO and had spent the years 1972-73 authoring the famous UNICEF guidelist "OLGA" for water supply equipment and materials.

Much of his time he would spend in South Lebanon at the project sites with the other UNICEF colleagues who were stationed in Qena, administered by Carl-Axel Larsson, another Swedish UNICEF veteran from Bangladesh. There were also water engineers John Andrews (UK), Larry Blais (Canada), and, during the early 1980s, the Yugoslav drilling engineer Mladen Zelenika (transferred in 1985 to Sudan). All this work went on until 1985, when UNICEF phased out the largest part of the water supply activities in Southern Lebanon.

One water engineer remained in his home city Beirut, where he now has taken over the responsibility for all of UNICEF's activities. Raymond Naimy made an international name for himself when in early 1983, Israeli troops had cut off East Beirut from the rest of the country and from its normal water supply. In order to prevent a major water famine among the city dwellers and their large child population, Naimy launched "Operation Water Jug", providing at least minimum quantities of drinking water to the beleaguered citizens. He used water from private borewells and brought it by truck to improvised tap stands at hastily erected water tanks until, after some precarious months, conditions were more or less restored to normal.

Other countries of North Africa, the Middle East and Europe

Other North African, Middle East and European nations with smaller scale UNICEF-assisted water and - less - sanitation inputs during the 1970s, were Morocco, Algeria, Jordan and Yugoslavia. In Morocco, a beginning was made to induce villagers in the Atlas Mountains to dig wells and to improve their sanitation. In Algeria, for about a year, around 1975, UNICEF provided pipes and fittings for local schemes in the Wilaya of Greater Algiers. The Governor himself was very enthusiastic and travelled around in his jeep, followed by trucks, distributing the pipes in person. What may have been lacking in planning, was made up for in terms of political impact and advocacy.

Jordan likewise was provided with materials for villages for the settlement of Bedouins from the desert. Yugoslavia, which by the 1970s was taking care of itself perfectly well, in 1974 was hit by a violent earthquake that destroyed the city of Skoplje in the Kosovo region. Part of the UNICEF emergency aid went into the provision of water supply materials for immediate relief.

THE AMERICAS REGION - THE OLDEST REGION-WIDE EFFORT

UNICEF's assistance to the Americas Region concentrated on relatively few countries and areas within these, normally the poorest ones. The water and sanitation projects would be supported in conjunction with other assistance provided within the framework of integrated services for children programmes. Among the reasons for UNICEF being proportionately less involved in water and sanitation in the Western Hemisphere, was the overall low funding ceiling as a function of the higher average levels of national economic and social indicators than those of other continents.

The countries of Latin America thus had a higher coverage with water and sanitation than Africa and Asia. The regional plan for development of the American states with definite targets and their follow-up, resulting from the Punta del Este Conference in Uruguay in 1961 attended by several American heads of state, was the first concerted development effort with a continental spread anywhere in the world.

Even though the targets set were not fulfilled, especially in the rural areas, given the circumstances, the results were encouraging. They proved that regional plans could be established and at least partly carried through, setting a precedent for later more world-wide actions. It prepared the stimulus and laid the groundwork for national planning and implementation in a variety of countries, representing different ethnic, political and economic systems.

Also, the follow-up to the Punta del Este Conference brought major international financing into play on an unprecedented scale, private and public. For community water supply and sanitation, especially the Inter-American Development Bank (IDB) provided funds, without which very little would have been achieved. The loans from this bank benefitted not only the big cities. Much went into water systems for small towns and large villages. The financing was accompanied by the active promotion of policies for community participation. This took shape in the form of local "juntas de agua" or water committees. In some countries, the social and political structures still wore the imprint of the Luso-Hispanic feudal and colonial past. The "juntas de agua" in some of these countries were to become the first modern democratic bodies, where the community people could meet, negotiate and decide over questions of common interest.

A good deal of IDB's strong influence is ascribed to its Chief Sanitary Engineering Adviser for many years, Humberto Olivero, later succeeded by Juan Alfaro. Large contributions were made by USAID and its precursors and - especially in rural areas - by a number of NGOs, many from the United States and Canada but also increasingly national ones. Some NGOs that had originated in the United States became entirely national as was the case with "Agua para el Pueblo" in Guatemala.

Yet another major supportive factor in terms of providing technical, organizational and managerial know-how in the Americas, was the Pan-American Health Organization (PAHO) with the Pan-American Sanitary Bureau (PASB). This organization, headquartered in Washington, D. C., is funded by the countries of the region. It functions at the same time as the WHO Regional Office for the Americas but retains a certain autonomy. Its historical roots are very interesting and relevant for the understanding of PAHO's eminent role in the development of public and environmental health concepts and methods worldwide.

Founded in 1902, PAHO/PASB is the oldest international health organization in the world. It served as a model, when the World Health Organization was created at the end of World War II out of the remainder of the relatively more limited International Health Commission in the framework of the League of Nations. The basic inspiration for the forming of PAHO was derived from the energetic public and preventive health measures taken in Cuba by General Leonard Wood and Dr. Walter M. Reed, 1900-1901, aiming at the eradication of the mosquito-carried yellow fever (which some years later was followed by similar measures around the Panama Canal, then under construction, through Colonel George W. Goethals with Dr. William C. Gorgas, based on the findings of the Cuban physician Carlos Finlay).

Through the decades and with more adequate funding than ever was received by the later added other regions of WHO, PAHO secured a strong network of representatives. This meant solid support to government health, water and sanitation programmes, assisted by sanitary engineers throughout large parts of the continent. A regional PAHO centre for sanitary engineering was established in Lima, Peru - CEPIS (Centro Pan-Americano para la Ingenería Sanitaria) - in order to provide technical backstopping and training. This was in some countries supplemented by national centres, such as CETESB in Brazil (Sao Paulo).

There were thus concerted inputs from governments and communities with substantial backing by international and regional organizations. Relatively speaking, there was also better access to water resources in the more rain-rich parts of the Americas than there was on the average in Asia or Africa. Technically it meant that piped schemes with household or patio connections, i.e. water taps for each family could be built to a much larger extent in Latin America than on the other continents.

The need for low-cost approaches, such as handpumps, simpler gravity feed schemes and latrines definitely also was there, but to a shade less than in the other UNICEF regions. One area with almost Sahelian conditions, which UNICEF did not venture into, was the North-East (Nordeste) of Brasil. This part of South America 250 million years ago had been joined with Antarctica, Africa, India and Australia into a supercontinent, which latter-day geologists call "Gondwanaland". The core of it was a mass of hard Precambrian rocks, ranging in age from 600 million to more than 3,000 million years back in time.

That rock mass split up with the continuous rifting of the earth's crust. The individual parts of this crust drifted away from each other at the rate of a few inches per year to form the present continents and subcontinents, including West and East Africa, Madagascar, India with Pakistan and Sri Lanka and South America. Combined with climatic drought conditions, some of these areas make for extremely poor present-day living conditions. This is the case with north-east Brasil, but the presence in the 1960s and 1970s of strong regional Brasilian development organizations, such as SUDENE and SUDAM was supposed to take care of the infrastructural problems.

The main target populations for UNICEF assistance in the Americas during the 1970s were scattered over the Caribbean, in southestern Mexico, Central America and Panama, Peru, Bolivia and Paraguay. Much of the action was ad hoc, hampered by the topography and the distances, a weak infrastructure, low government priorities, lack of budget and human resources and a low level of literacy and awareness among many of the communities.

The Caribbean

In the Caribbean, piped water supplies to larger and smaller communities were built with UNICEF-assisted materials, e.g. in Jamaica, and St. Vincent. Similar support was provided to the Dominican Republic. In Surinam pump and pipes were supplied to some more elaborate schemes, based on larger diameter deep wells, drilled under a UNTAB/UNTCD-supported project.

On Haiti, the absolutely poorest country in the hemisphere, some projects were provided with pipes and construction materials for communities on the southern coast. With the then government paying scant or no interest to the needs of its citizens, the Rural Water Supply Agency in the latter 1970s consisted of only one engineer, Harry Philippeaux, and one draftsman, an absolute minimum crew. Bravely they tried to grapple with problems of an impossible magnitude. Bilateral aid, notably USAID and a number of NGOs, did their best in an unco-ordinated way to fill the worst gaps.

There was a slight boost of international interest and compassion, when the northwestern peninsula was declared an emergency areas after a long spell of drought 1977. About 250,000 inhabitants were living practically on bare limestone rocks with only small pockets of arable soil. Any rainwater would disappear deep down into open fractures and sinkholes in the rocks. People would hardly have anything to live from and were burning the last of their scraggly bushes into charcoal for shipping it to the capital, Port-au-Prince as their only source of income. It seemed that when that last shred of covering vegetation was gone, nothing more would help. Erosion would take the last of their soils and the hard-to-catch groundwater would recede further into the bowels of the earth. The people in places like Bombardopolis or Môle St. Nicholas would literally be left high and dry. Lacking really sizeable contributions, UNICEF's inputs in Haiti had to wait until the 1980s before any major action could be undertaken.

Central America and Panama

In Central America and Panama, UNICEF provided materials and equipment to rural projects in Panama, Costa Rica and Guatemala. The catastrophic earthquake of 1976, which devastated large areas of the most densely populated highlands of Guatemala, necessitated the total rehabilitation of the villages along the earthquake zone. The government was so overburdened with other rehabilitation tasks that it left the aid to the rural areas independently in the hands of voluntary agencies and UNICEF. Remarkable work was done by these mostly small agencies, including a group of Guatemalteco engineers who dedicated month after month of their time, skills and energy to helping villagers rebuild their houses and install their water supply systems.

The UNICEF office in Guatemala, understaffed, overworked and in a state of shell-shock from the earthquake in 1976, was reinforced by a water project officer, a senior drilling superintendent, Alejandro

Amoretti, originating from Cuba. He had worked for the United Nations for a number of years, had long experience from Guatemala and was very familiar to the government. For years he played an important role in directing the right kind of assistance for village water supply to Guatemala and neighbouring Honduras and El Salvador.

Mexico - transmitting to the tzotzils and the tzeltals

A very special activity took place in Mexico during the entire 1970s. First, working under the aegis of veteran UNICEF Representative, Albert (Bert) Reynolds, then succeeding him as Representative for six years up to 1980, Bruno Ferrari-Bono, who used water supply as one of the basic services in support of the Chiapas Project.

El Programa para el Desarrollo de los Altos de Chiapas (PRODESCH) - the Programme for the Development of the Highlands of Chiapas - was both a complete development scheme and the name of the local organization to manage it, as set up by the Government of the State of Chiapas. It had all been set in motion by an unusually dedicated governor at the end of the 1960s. The political support unfortunately slackened by the mid-1970s and was no longer the same at the end of the Decade. Still, the first six or seven years had provided an impetus to leave a lasting positive effect on the lives and well-being of the local people

The population to be served and to be assisted in their social and economic development, to 90 percent based on self-help, were 600,000 American Indians in the forested-covered humid highlands of Chiapas. This area is situated on the border of Guatemala, east of the state capital, Tuxtla Gutierrez, with the famous Mayan ruins of Palenque and Bonampak in its northern confines. It consists of an undulating hilly plateau with an elevation of six to nine thousand feet (2,000 - 3,000 metres) above sea-level.

Few roads and no modern conveniences existed in these zones, inhabited by tzotzils and tzeltals and some other tribes, each with their different languages, all in their colorful costumes. On their own list of priorities, access roads to the villages stood as number one, then followed by a long enumeration of other needs. The PRODESCH administration under Licenciado Alejandro Rovelo Burguete, housed in a beautiful old ranch building on the outskirts of the historical city of San Cristobal de Las Casas, from the outset put emphasis on agricultural development.

In its work, PRODESCH was aided by an unusually effective co-operation between UNICEF, FAO and WFP. While UNICEF applied the full register of its basic services in one of the first truly integrated projects ever, WFP provided food for work. This included commodities which otherwise would have been difficult to obtain at reasonable cost, such as cooking oil. The work resulted in the construction of hundreds of miles of access roads, over which the water supply materials and other essential equipment could be brought in, and the agricultural products transported out to the markets.

FAO provided one expert in fruit and vegetable gardening, Ingeniero Ramón Briceño from Chile. He stayed on for eleven years in Chiapas, helping to lay a solid basis for what now seems to be a flourishing production of vegetables, fruit and flowers. That last product may sound esoteric but is an important part of the cultural tradition and a good additional source of income.

The water for the small terraced plots of cultivation came from the protected springs, which fed the villages with drinkable water through pipelines. Since a constant flow of water was assured through the regular and high rainfall, the excess water therefore could be diverted to the fields.

At the same time, health education campaigns supported the newly established system of local health care centres and helped spread the understanding of proper water use, sanitation and hygiene. A most original feature was the installation by UNICEF of a powerful radio transmitter at the PRODESCH headquarters. It would broadcast a round-the-clock programme with news, popular music, agricultural extension and educational messages to the people of the Highlands of Chiapas in their own languages. It was the first time ever in Mexico that such broadcasts were made in local languages other than Spanish. Radio PRODESCH gained instant popularity. In 1979 there was a daily influx of 250 letters from listeners. One interesting and successful use of this radio station was to forewarn and mobilize parents in remote areas of impending visits from immunization teams, for mothers and fathers to bring their children to the predesigned health centres in time for the scheduled arrival of these teams.

It helped that Bruno Ferrari-Bono with his wife Dora was an ardent radio ham. This Argentinian hydraulic engineer was a former professor at the Technical University of Buenos Aires, FAO expert for irrigation in Central America and, after Mexico, for a few years Senior Adviser with WET in New York. Following his retirement from UNICEF he rose in rank in his own country and for two years was Minister for Water Resources in the cabinet of President Raúl Alfonsin. A polyvalent engineer/humanist, his many interests strongly contributed to widening the scope of UNICEF's work in water and sanitation from being a purely technical concern to a support to the whole range of services for children.

The work in Mexico continued through the first years of the 1980s but had lost much of its momentum. In Chiapas, a voluntary women's organization undertook to manage some supplementary activities. During some years around 1982-84, spring protection with gravity feed projects were implemented with UNICEF funds by a small team, headed by engineer Pedro Velazquez Barrón (since 1985 UNICEF Project Officer in Bolivia). They worked hard against the odds of continued deforestation, erosion and disappearance, first of the topsoil then of the crops and finally of the villagers lured by the glitter of urban life to Tuxtla and Mexico City.

Peru - children in sack cloth

As in other parts of the world, a major natural emergency for a while attracted international attention to Peru. In 1972 an earthquake triggered enormous landslides, burying the entire Callejon de Huaylas Valley in Huaraz, several hundred kilometres east of Lima, and killed tens of thousands of people. It left surviving tens of thousands homeless and deprived them of any immediate means of livelihood.

On a more long-range basis, there was the "silent emergency", a constant one, of the Quechua and Aymara Indians, descendants of the Inca people. Still dazed by the after-effects of the Spanish conquest 450 years ago, they live numbed by cold and hunger and are dulled by the chewing of coca leaves to create an illusion of warmth and satedness. These villagers of the Altiplano of Peru and Bolivia lead some of the most miserable lives of any population on this earth. Their children, barefoot and clad in the proverbial sack cloth and ashes, spend their night-time in sub-zero temperatures, sleeping on reed mats on dirt floors in stone huts without any form of heating. During the daytime, they often find themselves neglected by their parents, who struggle hard for their own survival.

There are few other parts of the world where the need for UNICEF's action seems so strong. Among the remarkable features of this work during the 1970s, was the systematic building up of pre-schools in the villages, the "wawa-huasis". Operated by trained volunteers, their curricula for three- to six-years olds were based on the findings of the Swiss child psychologist Piaget, on the development of children's perception and behaviour. These pre-schools were reported to work wonders with the Inca tots, who upon entering primary school found themselves intellectually and emotionally at a great advantage over the other children.

The "wawa-huasis" and their villages in the districts of Puno and Cuzco, on which UNICEF's assistance concentrated, needed safe water. The seemingly clear creeks and rivers of the Altiplano at elevations of over 4,000 metres (12,000 feet) are heavily contaminated with fecal matter from humans and animals. Consequently, supplies were provided by UNICEF in Lima with the help of the supply officer Mercedes (Micha) de Villavicensio, for wells drilled with cable tool rigs, handpumps and construction materials for spring protection. Although certainly the political willingness was there, the technical support from the government was weak. It was difficult to have qualified technicians stay on in this remote and difficult area, when there were so many more attractive and remunerating jobs in the cities. In the 1980s, UNICEF could strengthen its support through consultants, although the funding levels remained low.

Bolivia - how to hijack a drill rig at gunpoint

Continuing from the 1960s, the Departamento de Saneamiento Ambiental (Environmental Sanitation) of the Ministry of Health, through district technicians helped villages build community water supply systems and individual household latrines. UNICEF assistance went to such work in

the provinces of Cochabamba, Oruro, Tarija and Chuquisaca. In the Altiplano, the highlands, these were predominantly spring-fed piped systems. In the lowlands east of Cochabamba, handpumps (still an old cast-iron model from the United States) were installed in dug wells for Indians who had been resettled for economic reasons from the Altiplano to the outreaches of the Amazon Basin and the Gran Chaco plain.

Some drill rigs had been provided by UNICEF for water well drilling. One of them incidentally, around 1977, suffered a curious fate. It was hijacked from the Saneamiento Ambiental warehouse in Sucre by a highly intoxicated gentleman, brandishing a huge revolver. Some kilometres further away he promptly capsized with the 18-ton outfit in a ditch and disappeared.

The Departamento de Saneamiento Ambiental for several years was headed by an energetic sanitary engineer, Carlos Chavez, who "por la fuerza o la razón", tried to get the villagers to build and use latrines in their households. This was an early and valid attempt to satisfy that part of the fight against diarrhoeal and other feces-related diseases. The advent in the late 1970s of an equally energetic and resourceful UNICEF programme officer, Ms. Enedelsy (Nelly) Escobar-King from Panama signified a good strengthening of these efforts.

Paraguay - counting buckets for the clausura

Landlocked and sharing its major river systems with the neighbouring countries, Paraguay often tends to be overlooked in world-wide international contexts. Yet is has its very distinctive and interesting characteristics and history. It is the only country in Latin America where an indigenous people, the Guaraní, has had its language raised to official status as national language side by side with Spanish. There is besides the majority of Guaraní people, an international grouping of Paraguayans of Spanish and other European descent, Japanese and Mennonite farmers. The general level of income and other socio-economic indicators are among the lowest on the continent.

For the larger villages or small towns - it is difficult here to uphold any clear distinction between rural and urban - water supply by conventional installations with house connections is fully feasible. The difficulty was to bring safe water to the small hamlets and individual households between the towns. This lay at the basis of an informal but effective co-ordination between the government agency, SENASA (Servicio Nacional de la Salud), the World Bank and UNICEF. In 1976 the World Bank undertook to finance water supply to all agglomerations over 2,000 inhabitants in the three central provinces, whereas UNICEF was to assist the small settlements in between with dug and drilled wells and handpumps.

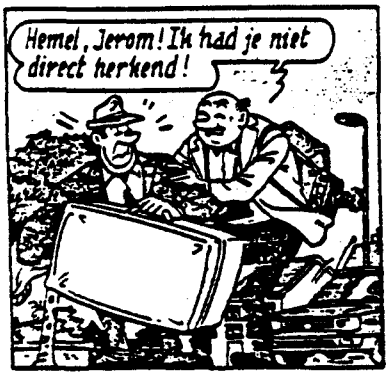
The introduction of water supply to the rural Paraguayan communities was accompanied by impressive health and sanitation education campaigns. These were all-out teach-ins in primary and secondary schools, normally scheduled for a whole month, with the "clausura" coinciding with the inauguration of the water systems. Day in and day out, the school children would be brainwashed with matters concerning water, sanitation and hygiene. In mathematics, they would count buckets. In biology, they would study all the bugs in a drop of untreated water. In Spanish, they would write poetry about the beauty of clean water.

At the head of these campaigns stood Margarita Cardenas, Chief of the Section for Sanitation Education of SENASA. This dynamic, highly motivated and inspiring Paraguayan lady and her staff were so successful in their teachings and promotion that parents sometimes complained that their children would come home and be insistent over new-fangled ideas of sanitary latrines and personal hygiene! Little wonder that UNICEF in 1980 in the first planned attack on the health education barrier in Pakistan, selected Margarita Cardenas as the organisation's first health education specialist in the field!

Suske en Wiske: UNICEF handpumps make it into the world of cartoons

Suske and Wiske, brother and sister, together with the ever jovial, bumbling Lambik and terse but practical Jerom, are the heroes in a Dutch comic strip. They are the creation of artist Willy Vandersteen, who is known to millions of Dutch and Flemish readers, children and adults alike. In his November 1979 issue, he presents his heroes as "De pompenplanters" - "The Pump Planters".

We were deeply touched because, in addition to using UNICEF handpumps, the whole cartoon ends with a plea to help UNICEF do its work for the children of the world. However, it was first necessary to fight a group of gangsters, who used the pumps for their own selfish, brutish end to produce diamonds instead of healthy children. Our new Project Officer (Water Wells and Hand Pumps), Jerom, not without assistance from extraterrestrials in a Flying Saucer (no doubt equipped by UNIPAC), finally sets things straight.



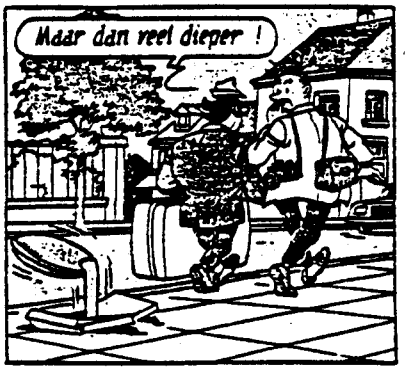
Heavens, Jerom! I hardly recognized you!

Tell me, are you leaving town?

Yes, far away...overseas!... Got a job with UNICEF! World organisation to help poor children!

And what's your job?
- Install pumps for safe water!
...Got to drill through hard granite rocks...Tough job!

It is like this...I'll show you with this street lantern!



But in reality much deeper!

1980 through 1986: Clarifying the objectives and establishing the links with CSDR and PHC

In order to understand the events of the last years since 1980, it is necessary to know the basis for international policy development of the preceding decade. During the years 1972 to 1985, a series of world-wide United Nations Conferences were held, the topics and resolutions of which formed an important basis for the work on community water supply and sanitation jointly between governments, international and other organizations. They were referred to in chapter 1.2, especially in terms of the objectives and goals set for the different actions to improve the health and environment of all human beings.

The definition of the overall objectives of the resulting Water Decade and related international action coincided with the clarification and further sharpening of UNICEF's objectives towards diminishing infant and child mortality and morbidity rates. The introduction of the intense promotion by UNICEF of a few specific preventive and curative actions towards this aim were summarized in the acronym of GOBI (Growth Monitoring, Oral Rehydration, Breastfeeding and Immunization). Later these were included in CSDR (the Child Survival and Development Revolution) with UCI (Universal Child Immunization) as the spearhead.

There were fears among many of the colleagues in UNICEF that water and sanitation would be "dropped" from the organization's activities during the first years of the intense promotion of the GOBI elements, claimed by some to be "more cost-effective". Such apprehensions and also doubts from some international health specialists and economists as to the value of investments in water and sanitation had been voiced time after another in major institutions and organizations, such as the World Bank, USAID, the German, Swedish and other international and bilateral organizations during the last thirty years. The debate still goes on, but seems to have regained more balanced proportions.

With all this are linked the rapidly evolving technologies, insights into the social patterns of knowledge, attitude, practice and the fascinating widening of discoveries, methods and practices in the health sciences such as epidemiology and biomedical studies. It makes the matter of the effects on the human organism of water and sanitation including hygiene much more complicated than it seemed in 1960 or 1970.

The scientific knowledge thus becomes all the more important, when it has to serve the monitoring and the evaluations, the planning and design of programmes, projects and facilities. It definitely makes an end of the concept to treat water supply as a purely technical matter, to be dealt with as a public works activity. It forces an understanding of the interdependence of water with sanitation, nutrition, health, education and everything else.

Research at hundreds of institutions, the successful implementation of worldwide disease research and eradication programmes such as those headed by WHO: smallpox, onchocerciasis, diarrhoeal diseases, tropical diseases - all have in them important elements of water, sanitation and hygiene. Water supply and sanitation alone without any complementarity with each other or with other interventions, have proven to be only part solutions and unsatisfactory at that.

New epidemiological and biomedical factors have become known only in the most recent years. The water-borne diseases of old are no longer exclusively water-borne. For example an important part of diarrhoeal diseases has proven to be caused by a group of viruses, named rotavirus, which in addition to the spread by the oral-fecal route can be transferred in other ways, even in the air by coughing.

Consequently, for the studies and evaluations of health impact of water supply and sanitation, the indicators are less clear now than they were, say, in 1980 or earlier. Thus measures of diarrhoea incidence frequency are fraught with too many uncertainties. The present best bet seems to be though the same anthropometric measures as used by the nutritionists and as practiced on infants and young children through growth monitoring. Again, the causes for changes and deviations from the normal range are so manifold and intricate that the conclusion up to now is that water and sanitation cannot be singled out for impact evaluations. Health impact cannot be measured in absolute terms for any single type of intervention.

This was the conclusion of the first international seminar ever on the subject of health impact of water and sanitation, held in 1983 at Cox's Bazaar, Bangladesh. The results of research and studies, as presented there, as well as derived from other institutions in the world, are constantly being evaluated by UNICEF. The organization's policies, approaches, advocacy and field work are continuously being adapted, following the conclusions of such research.

With the above in mind, the new art of evaluation of water supply and sanitation was applied on a long-range basis in the Imo State programme in Southeastern Nigeria. This programme was the first ever designed from the beginning in 1980 with water supply (drilled wells with handpumps) and sanitation in combination with PHC and CSDR measures. The London

Toilet training: Typical evaluation procedure

School of Tropical Medicine and Hygiene under Dr. Richard Feachem, seconded on a long-term basis an epidemiologist, Dr. Deborah (Debbie) Blum, to UNICEF Nigeria, in order to carry out a full health impact study in Imo State. This study was built into the programme from its inception. It will become a major step towards the understanding of these kinds of programmes and their effects.

The social effects and economic effects, too, became much clearer after research which began in the 1960s and 1970s by social, economic and health scientists. Studies in East Africa by Gilbert and Ann White (University of Colorado), jointly with David Bradley of London University (published in 1972 in the classical book "Drawers of Water") showed the many relationships of behaviour and practicality of rural water supply to the communities. Researchers such as Mary Elmendorf (USA), Kirsten Jorgensen (Denmark), Mary Racelis (Philippines) and Christine Wijk-Sijbesma (The Netherlands) dealt with social and women's problems in this context.

The effects on human health are both direct and indirect in terms of what often loosely and somewhat off-handedly had been termed "convenience" as to the need for bringing water closer to the domiciles. Studies on body energy expenditure were made by the late Dr. Raymond Isely (University of North Carolina/USAID/WASH), clearly showing the direct effect of relieving pregnant, lactant or any other women from the drudgery of hauling water. A first valid attempt to study the convenience factor in a UNICEF-assisted programme, was done in 1980 by Anne Marie Russell in Bahr-el Ghazal Province, Sudan, which showed the enormous difference in use of personal time of women before and after the installation of handpumps.

The economy of low-cost water supply and sanitation had been little explored until 1982, when the World Bank began a study of the economy of handpump systems. Among the purposes was to prepare the background for World Bank policies on the promotion and financing of projects using low-cost technologies. The preliminary findings of this study were presented in draft form in late 1985. They confirm much of what pragmatically had been estimated and lays a good ground for the continued studies that will be needed.

One of the big bottlenecks in the whole global system in its work to try to reach the goals of the Water Decade, is Human Resources Development (HRD): Organization and development of the human skills to do the big work of the Decade. If the original targets to provide water supply and sanitation to everybody by 1990 were to be fulfilled, it would mean that new water supply installations would have to be provided for 500,000 people per day.

Even though the actual rate of new construction would be lower than that, a tremendous amount of work is carried out all the time. This requires the skills of millions of people: engineers, teachers, public health specialists, administrators, handpump caretakers, children, mothers and others.

Far from all these people are there, where and when they are needed. Their salaries are low. They often lack the transport, the tools, the funds, the management, but especially the skills.

And not only that, engineers, water well drillers, sanitarians, health educators and social scientists need to adapt their work to the local requirements. Some of the more high-falutin' ones may have to change their concepts of technology and people considerably.

Human Resources Development (HRD) is the keystone in any development venture. Therefore, it now is subject in the international world to the attention of a special Task Force of the Decade Steering Committee. Our hopes are that out of this Force will spring a co-ordinated and well-publicized effort to guide and support people all over the world in their training.

A lead role is with WHO. In Geneva, Sanitary Engineer Neil Carefoot keeps HRD together, based on his unique experience of training water people in Latin American and the Caribbean. The WHO environmental health people around the world have HRD as one of their main inputs. The Regional Offices of WHO are very active in the field, e.g. with Marilyn Rice (health education) and Horst Otterstaetter (HRD/Training Methods) at PAHO in Washington, D. C.

Training especially for water well drilling, handpump installation, latrine construction, village sanitation and health education is a prime task of UNICEF's 150 or so water, sanitation and heath education specialists.

The World Bank has developed training aids with financing from UNDP as an introduction to low-cost water and sanitation: slide-sound show modules for fixing anything from finances to rainwater collection. John Kalbermatten recently left the Bank but still keeps a hand over HRD. Michael Potashnik moved from UNDP to deal with the economic aspects of HRD at the World Bank. A major part of the work is in the hands of Dr. Letitia Obeng (Jr.).

Another set of similar slide-sound materials was the responsibility of economist/engineer Klas Ringskog of the World Bank's Economic Development Institute. All this is supplemented by IDRC (the International Development Research Centre) and CIDA of Canada with films for introducing the ideas in an easy-to-understand way. Just watch the way the glowing fecal contamination insidiously spreads through water, soil and dirty hands in an animated part of the IDRC film, "Prescription for Health".

Donald Sharp is the moving force of IDRC. Two other Canadians contribute strongly. Michael (Mike) McGarry and Brian Grover, who for many years have worked as prime consultants to the World Bank and other international bodies. John Austin of the United States Agency for International Development (USAID) is another major force. Going on with the Americas, there is the Pan-American Health Organization Centre for Sanitary Engineering in Lima, Peru: CEPIS, headed by Alberto Flores and its Brasilian counterpart, CETESB in Sao Paulo.

Across the Pacific, there is the Asia Institute of Technology (AIT) in Bangkok, the WHO Centre, PEPAS, in Kuala Lumpur, with Somnuek Unakul as its Director (recently moved in from WHO in Geneva). National institutes include NEERI in Nagpur, India and the Indonesian Institute of Technology in Bandung.

On the African continent there is the CIEH, the Inter-African Centre for Water Research and the neighbouring engineering school in Ouagadougou, Burkina Faso. Sudan hosts the Training Centre for Water Technicians at Wad Magboul (including training of water well drillers).

Europe is the base of ILO with previously John Wallace, now Arpad Könye in charge of water-related issues of - especially - vocational training. The International Reference Centres in The Hague (IRC) headed by Hans van Damme, and Duebendorf, Switzerland (IRCWD) with Roland Schertenleib have an important function. France has its CEFIGRE under Jean-Paul Mounier in Sophia Antipolis on the Côte d'Azur and the Fondation de L'Eau in Limoges. Both are intensely involved in training, with both French- and English-speaking courses.

Then there is the host of universities: Dakar, Addis Ababa, Barcelona, London, Tampere, Cairo, Beirut, Damascus, Lahore, Hyderabad, Dhaka, Rangoon, Ottawa, North Carolina, Cornell, Wright State in Ohio, Buenos Aires, Medellin, among many others. Voluntary organizations play a very great role, such as the Kenya Women's Association, AFPRO and the Water Development Society of India.

All the above factors and fields of study and development would contribute to the development and use of the monitoring and evaluation methodologies. They are indispensable tools for the proper, efficient and economic management of any programme and project. The first valid attempt at summing up and systematising such work, was done in Lesotho in 1977-78 for the Overseas Development Agency (ODA) of the United Kingdom. Among the authors of a series of publications on this topic were Richard Feachem and Sandy Cairncross (London School of Hygiene and Tropical Medicine).

Their books were followed by the most practical guideline to date, the "Minimum Evaluation Procedure" from WHO, authored by Gunnar Schultzberg of the Environmental Health Division in Geneva. UNICEF's Planning and Evaluation Section in New York, first through Farid Rahman, then continued by Ms. Eimi Watanabe, dedicates special efforts towards working out evaluation methodologies geared to the specific needs of UNICEF in co-opeation with WHO and IRC.

This also facilitated a rise during the 1980s in the number and scope of evaluations and audits, carried out of different UNICEF-assisted water and sanitation programmes and projects. In India and Bangladesh, bilateral donors seconded special staff to the UNICEF offices for making continuous long-term evaluations (SIDA through Bo Elding in Delhi and DANIDA through Kristian Laubjerg in Dhaka). Other evaluations were made jointly e.g. with the United Nations Capital Fund (Rwanda) and with the Ministry for Economic Co-operation of the Federal Republic of Germany (BMZ) in Bangladesh, Burma, Nepal and Sri Lanka. These joint exercises had the purpose of finding out what happened with the often considerable amounts of donor funds allocated particularly through special contributions. They also served to show the donors' own bilateral organizations how to go about the policies and practicalities of the low-cost, community-based approaches, strongly advocated and supported by UNICEF at an early stage.

The social approaches were further systematized. Experiences were collected, corroborated and spread by UNICEF in close co-operation with other bodies, such as WHO, IRC, UNDP and The World Bank. A series of workshops was held for this purpose during the years 1980 - 1981 in different UNICEF regions.

As concepts wax and wane in any human endeavours, so do buzzwords in the international world. The "grassroots" of the 1970s were replaced - hopefully for the duration - by "community participation". The "Project Support Communication (PSC)" in UNICEF parlance, was turned into "Programme Communication" in order to stimulate and support "Social Mobilization".

Behind the buzzwords lay the realization and urge to secure not just the digging of wells and pipe trenches by villagers but their involvement in the whole process of decision-making, planning and implementation. It aimed at making the users in the communities aware that the water supply and sanitation facilities were theirs, there for a purpose and their responsibility to operate, maintain and repair.

The need for active participation of the communities in water and sanitation projects also coincided with the same need in other development sectors, including child health, education and nutrition. Therefore the UNICEF support in the 1980s found more and more of this element included in the programmes.

The role of improved water supply and sanitation for women's advancement and the need to increase the involvement of women in the programmes, was systematically explored from 1980 onwards, as was also previously described.

Health education became a mandatory element in all programming. The post of a health education specialist in UNICEF's New York Headquarters was a key point in promoting the idea. It worked very efficiently. An unofficial aim was to widen the scope of this health education promotion beyond the water and sanitation field and to begin using it to support the PHC, CSDR and UCI efforts. Therefore it came as a surprise when a management decision was taken to abolish the health education post by 1986, although the functions to some degree were assumed to be taken over by the new Programme Communication Section of the Programme Division. The health education components of water and sanitation programmes would henceforth be in the hands of the specialists in the field, with the hoped for possibility of having them temporarily released from their normal country programme duties, should the need arise for expertise elsewhere in the world.

The technologies continued to develop. Major steps forward were taken in terms of equipment and materials for water supply. The highspeed drill-rigs were made even more efficient, compact and easier to handle. Compressed air partly was replaced by hydraulics. New polymers began to be used for drilling fluids under difficult conditions. UNICEF continued co-operation with drill-rig manufacturers in order to get rigs developed that would be lighter and less expensive. Some of the big monsters as used in some areas, albeit with difficult rock conditions,

cost up to half a million dollars! No doubt they were immensely powerful and efficient, but every cent would count and the rigs had to be kept down in size for transport over narrow and difficult roads and bridges as well as for lower operation and maintenance costs.

Water lift was another main technology line, pursued with great enthusiasm by the UNDP-funded water and sanitation group at the World Bank, including the "TAG" (Technical Advisory Group). The importance of this work for UNICEF cannot be underestimated. The project for developing and testing low-cost sanitation methods and latrine design laid the technical basis for UNICEF's own advocacy. In several countries, e.g. Lesotho, Botswana, Tanzania and India, UNICEF took over, where the TAG people had to leave off, for funding after proving the viability of the methods. The fact that the testing and development lay in the hands of the World Bank, enhanced the respectability of the subject matter. It allowed UNICEF to piggyback on the initial successes of the World Bank and other organizations.

One particular success story was that of the VIP (Ventilated Improved Pit) latrine, developed at the Blair Research Institute in Harare, Zimbabwe. Its inventor is an entomologist, Dr. Peter Morgan, whose insights into the psychology of flies, led to this ingenious design: flies, attracted by the odors from the pit, fly into it, do whatever flies do, and then, once properly satisfied, happily fly up the vent pipe on the outside of the outhouse, now attracted by the daylight through the vent. Only - this is where the fly stops - they cannot get out for a mosquito net covers the open top. The flies have too short a memory to remember where they came from, get confused, buzz around, starve, get weak, fall down and die, not necessarily in beauty. This is an example of technical development, as used on an increasing scale by UNICEF. (In 1986, because of his development of the VIP Latrine, Dr. Peter Morgan received one of the four Awards for the Best Inventions for Development by the Swedish Inventors' Association from the hands of the King of Sweden.)

It is similar with handpumps. A UNDP/World Bank project deals with the testing and development of these seemingly simple implements. UNICEF is possibly the largest handpump buyer in the world, and has a great stake, interest and investment in this field. There is a potential market world-wide of one million handpumps annually, China included with potential benefits to some 150 million new users per year. Not only the quantities matter. So does the design, quality, cost and ease of operation and maintenance. UNICEF, along with several bilateral agencies, actively participates both in the supervision of the project (through the chairmanship in an Advisory Panel) and, above all, in the field testing and development of improved handpump designs. After standard laboratory tests at the Consumers' Association Laboratories in England, a huge field testing scheme is underway of 2500 pumps, of 70 different makes in project areas in 16 countries. The aims are to define the best handpumps available, to stimulate improvements of existing pump designs and the development of new ones that would fit the VLOM (Village Level Operation and Maintenance) concept as stated by the World Bank Chief for Technical Development, Shaul Arlosoroff.

Alternative energy sources, as opposed to the conventional ones of fossil fuels and electricity, in the 1980s were further developed and began to be manufactured on a large scale with a drastic reduction in cost. Solar cells that convert sunlight to electrical energy, went down in cost from US $30 per watt in 1980 to about US$ 7 in 1985. Consequently there was a surge in procurement and use of this type of equipment, especially in West Africa.

Nigeria - Imo State: Imagination and Innovation

A clear promotion of the introduction of all these elements into the programmes, the concepts of the health and social approaches, the complementarity of all the measures, began to take shape in these first years of the Decade. The one programme in which all these factors were planned for from its very inception, was the PHC-water supply-sanitation programme in Imo State in southeastern Nigeria. It was conceived by the UNICEF Representative, Richard Reid, a US educationalist, who rapidly picked out the essential ingredients of GOBI, water supply and sanitation technologies, added a solid build-up of a PHC system with a backbone of Village-Based Workers (the "VBWs"), shook the mixture vigorously and applied it to some of the poorest districts of Imo State.

The judicious blend of components and the enthusiasm that Richard Reid infused into the local health teams and water supply technicians, with the establishment of a good UNICEF support team, made the project a success and a model. At first, the entire idea of solving the problem of rural water supply with drilled wells and handpumps met with considerable resistance at both Federal government and State levels. While the oil prices still were high, Nigeria could afford at least to plan for infrastructure improvements at much higher technical levels than what the country could have afforded before the great oil discoveries in the Niger Delta. For water and sanitation this meant water treatment plants, urban distribution systems and sewerage - where there was water around in some abundance, i.e. mainly in the areas close to the Niger river system.

The largest part of Imo State, and for that matter most other states of Nigeria, have no or little access to surface waters. Groundwater is therefore the only source that can be tapped. Also the limitations of size of the individual villages and the limited reserves and recharge of groundwater would be prohibitive for any major waterworks and piped network system.

Once the original objections had been overcome, Richard Reid with his colleagues of the UNICEF office in Lagos and with the Imo State health authorities, designed an approach with the drilling of wells and installation of handpumps, accompanied by the training of VHWs, and getting them to function. An interesting feature was the mandatory provision of latrines to half of the villages, before they would be allowed to have their handpumps installed. This laudable but difficult approach eventually had to be modified. The programme, nevertheless, was a great success. In 1985, the Federal government of Nigeria, at the insistence of the other state governments, decided to spread the handpump cum PHC strategy over the whole nation, with UNICEF-supported beginnings made in two other states, Gongola and Kwara.

Much of this innovative and successful application of a combination of services including a strong CSDR element, can be ascribed to the systematic community motivation, health education and training components. The enthusiastic UNICEF team, operating out of the Imo State capital Owerri, had a good mix of health educators such as the Nigerian national officers Arit Abasiekong and May Anyagbolu, rural development specialists with Marie Aig-Ojehomon from the Netherlands, hydrogeologists Sigurd Holmberg (Sweden) and Carel de Rooy (Netherlands/Brasil), water well drilling specialists Ulf Olsson and the chief mechanic/instructor Bengt Andersson, both from Sweden. The latter earned the nickname "No Junk Man" for his ability to convert parts of scrap and abandoned vehicles and machinery into workable machinery. Thus the cooling system from an abandoned bus became an electric water pump fitted to a mobile water tank.

Africa (other than Nigeria) - "A luta continua" - "The struggle continues"

The wide-flung and large array of countries in Africa with their inherent problems of overpopulation, environmental degradation, droughts, poverty, and weak administrations required both continued assistance and the mechanism to help plan, deliver, monitor and evaluate from the side of UNICEF and other external organizations. Two Regional Advisers' posts for water supply and sanitation had been established during the mid-1970s for East Africa (Nairobi) and West Africa (Abidjan).

The East African post was originally held by C.K. (Roger) Stapleton. It was abolished when Stapleton retired in 1979, and then reinstated in 1981 with Dr. John Skoda as the incumbent.

The West African regional adviser post during the end 1970s to 1982 was held by Marcello Bevacqua and subsequently by the French hydrogeologist Christian Hubert, previously the UNICEF project manager in Benin. Both posts place great demands on their holders, given the large extent of the area in which they have to function in an important advisory and monitoring role.

While in the other regions UNICEF's work continued in the framework of regular long-term programmes, the East and West African regions together with Sudan, from the end of 1984 and through 1985, had to put all their energy anew into combatting the effects of the resurging drought. The years in between had not been easy either. The great plans drawn up by the Sahel countries through CILSS (Comité Inter-Etats pour la Lutte contre la Sécheresse au Sahel) with UN backing immediately after the 1972-73 drought, only partly came into fruition. The important aspects of building access roads and expanding transport capacities, as well as to improve range and water management, and grain and other food storage facilities, largely remained unattended.

When the international world rallied briefly in 1985 to help alleviate the new emergency situation, it was again confronted with the same problems faced twelve or thirteen years earlier. There were more experiences available. There were more specialists and equipment around. Yet, when large contributions had been made - billions of dollars in food grain and financing from bilateral and international

sources, as well as hundreds of millions of dollars in funds from the public - it still took too long a time to analyze and specify the need, to plan and programme properly and to mobilize all the good forces in time. The large musical campaigns of Band Aid and Live Aid, which were an unprecedented manifestation of human solidarity through the electronic media in mid-1985, brought together funds in the order of 100 million US dollars. Yet, by spring 1986 it seemed that not even half of those millions had been spent. This was not the fault of the new funds but indicative of the slowness of the entire relief system which is dependent upon national plans and authorities, jointly with the complexities of the international agencies and the normal constraints of transports, logistics, human resources and political and administrative conditions.

Whatever funds would be used through UNICEF for water and sanitation would be well spent. Certain types of projects, in addition to providing potable water to households, involve water supply also for family food production with small-scale or micro-irrigation. The projects in Senegal, Mauritania and Mali with the cultivation of mainly tomatoes and onions, have become very popular. They have contributed to a better food and nutrition situation and keeping the local populations from migrating away from their villages. They have found something to live from and to improve their economies with. In Sudan, the UNICEF/WHO Joint Nutrition Support Programme (JNSP) similarly includes water supply from sub-surface dams for small cultivations.

In Africa, the programmes and projects after 1980 tended to include more health and nutrition components. A certain strengthening of UNICEF's technical backstopping is taking place gradually in the Sahel region, and the co-operation between UNICEF and UNDP/UNDTCD continues. The concepts of sanitary excreta disposal and other sanitation measures began to spread in many project areas.

In Senegal, a remarkable co-operation between UNICEF and a major NGO, Soroptimist International, began to take shape. Backed with large scale funding from Soroptimist branches in European and North American countries, the Senegalese Soroptimists are now helping to organize self-help schemes for community and family food production development. This includes the provision of water through drilled wells. The process is still a slow one but the results are encouraging.

In Mali, Burkina-Faso (formerly Upper Volta), and Niger ,the water well drilling cum handpump installations continue. During the first half of the 1980s, UNICEF built up its own support staff, especially in Burkina-Faso, with a water specialist team headed by French hydrogeologist Philippe Chaperot, a Swiss Master Driller Anton Schaller and Jean Pierre Chevasson. These activities were directed mainly to the northern, drier parts of the country.

An interesting development in Mali was the starting up of a local manufacture of the India Mark-II handpump in the town of Sikasso. A local modification of the pump cylinder helps provide greater quantities of water, which it is hoped will enhance micro-irrigation of family gardens.

In Niger, most UNICEF assistance with strong sanitation components, went into an area south and east of Zinder, also extending towards Agadès in the north and further on, towards Tanout. For some years the sanitation element was taken care of by a sanitary engineer from Liberia, Hylton Parkinson (now in Somalia) while Robert Larsson, a US civil engineer now in Tunisia, took care of the training of handpump repairmen. Most important to the work in Niger was the co-operation with UNTCD and CTP (Pierre Cherlot), including a sociologist, Mr. P. Paris, and the important mechanical maintenance assured by Jean Paul Geslin.

Further east, the present larger UNICEF inputs were developments only over the last few years since 1982-83. In the Central African Republic and Chad, any activities had been hampered by the political situation. In the Central African Republic - while it was the Central African Empire - water well drilling was out of the question, reputedly because Emperor Bokassa feared that evil spirits might be released through the boreholes. This constraint - if it was true - was overcome with the fall of the Emperor. In 1985, after an initial period of difficulty in starting up of a water project in the area of Bossangoa, north of the capital, Bangui, the drilling of water wells and installation of India Mark II handpumps came into a phase of regular and ordered construction. The present Project Officer, Mohammed Yacoub, an Afghan hydrogeologist, brought with him several years of experience, first from UNICEF in Abidjan and then the management of a crucial phase in the Benin programme.

In Chad, the civil war, with its outside pressures, had left any progress from previous external assistance extremely fragmentary. During the somewhat quieter years from 1984 on, a substantial water well drilling programme continued to be achieved under the supervision of Swiss hydrogeologist Alain Mathys. Since the administrative and technical capacity of the country is still low, this work continues to be implemented through a contracting firm. The hope is that at long last the Chadians will be reconciled with one another and the government will be in a position to truly develop its own potential.

Easily overlooked for its remoteness and small size, is Cape Verde, the republic of small islands in the Atlantic, some hundred kilometers due west of Dakar. These islands were abandoned by the Portuguese in 1975. Their departure and the continued effects of the Sahel drought caused great difficulties for their presently 300,000 inhabitants. To this was added the volcanic nature of the island which poses very special problems for water supply.

During the 1970s and beginning of the 1980s, the Cape Verdean engineers drilled and tunnelled for water in the lava and tuff (volcanic ash) flanks of the extinct volcanoes. Long "galleries" or tunnels were driven with a slight incline upwards into the mountain sides, piercing natural underground lava barriers in order to tap the groundwater, dammed up against them. Some of this water is so abundant that it is used for small-scale irrigation as well.

On some of the mountain tops experimental installations were made of large screens. Water vapor from passing clouds would condense on these screens and the resulting drip-off collected for drinking water. Further such experiments more recently were taken up in the coastal desert of Peru.

West Africa South of the Sahel - Victory over vectors?

In West Africa south of the Sahel, the wooded savanna and rainforest zones would not suffer to the same degree from the drought phenomena. Nevertheless, even the rainforest areas would have up to six months of dry season with nary a drop of water and with smaller water courses drying up entirely. This is the period, which in the Anglophone countries is labelled the "hungry season", a good indication of the problems of drought annually recurring there. Add to this the high incidence of all sorts of diseases, caused by the lack of water, contaminated surface waters, dirt, feces and lack of health awareness, high infant and child morbidity and mortality, and - on top of everything - the presence of vectors such as Anopheles (the malaria mosquito) or the tsetse fly. It all goes to show that UNICEF's presence was highly justified in the countries situated in these more humid zones, too.

Hand in hand with the infectious diseases go the needs for improved nutrition, especially in qualitative terms in order to provide the necessary proteins, fats, vitamins and minerals absent in the starchy staple foods of cassava or the imported white rice. Again, the provision of water supply from safe sources, combined with adequate sanitation and health education would form an essential basis.

The droughts extend their immediate effects further south. In the acute drought emergencies, uprooted populations from the north migrate southwards, adding an additional burden of soil use and deterioration. Already under normal circumstances, the continuous soil destruction through the physical and chemical degradation of the original tropical soils, especially into the true laterites with their extremely poor composition of iron and aluminum hydrates, constantly press the borders between the Sahel and the more humid savanna further south, sometimes several miles per year. Simultaneously, the border between the savanna and the rainforest moves southward at the same rate, threatening eventually to eliminate the rainforests of western and central Africa completely. This again has increasingly severe consequences on the millions of people living in these areas. The soils of the rainforests are quickly destroyed through the slash-and-burn agriculture. A few three- or four-year cycles of cutting down the forest, burning it and cultivating the land, turns the high forest into open fields with hard iron-pan crusts and a sparse vegetation of andropogon grass.

The complications of recent and contemporary politics are added to these already precarious environmental conditions. Some of the countries, worst hit by this combination, were the former Portuguese colonies of Guinea Bissau, Sao Tome and Principe, Angola and Mozambique. So was the former Spanish possession of Guinea Equatorial. All of these gained their independence only around 1975 and were completely abandoned by their former colonial powers. It left the new governments totally unprepared and the populations with hardly any skills and only a minimum or nothing of basic services. Large areas of these former colonies were war-ravaged at that, with internal struggles continuing in some of them.

Guinea Bissau had no rural water supply whatsoever in any sanitary form. After independence a good beginning was made through a UNTCD-managed water well drilling project, for years headed by a USSR hydrogeologist, Leonid Stepanishchev. The drilling part was taken care of by Gustavo Aliaga from Chile, the yachtsman, who had crossed the Atlantic several times in a small sailboat accompanied only by his wife (and later working with UNICEF in Angola and Haiti). UNICEF contributed part of the funds for this project, including the procurement of the ingenious "Vergnet" foot pump, manufactured in France (invented by two young French engineers and geologists, working with CIEH in Ouagadougou, Messieurs Vergnet and Benamour).

This first phase of the activities in Guinea Bissau still followed conventional lines. The second one began in earnest around 1982 and is more community-oriented. It involved the digging of wells by the communities themselves under the supervision of local, specially trained well-diggers, "puisatiers". The work was done in a wider context of community development and motivation, with the entire project carried out on contract with UNICEF for funding with a special contribution from Denmark (DANIDA). The contractors are CIEPAC in Dakar, an offshoot of IRFED, a consulting social science group in Paris, which originated decades ago with the involvement of some of the politicians around Roger Debré and personalities such as Paul-Marc Henri, the some-time Deputy Administrator of UNDP.

There was some controversy around the principle of hiring a long-term outside consulting group to implement the work. This delayed the programme with about one year against some uncertainty, whether the work would be carried out satisfactorily at the customary rate. In the end the results were encouraging. Although the number of wells dug was low, there is now a cadre of some fifty well-trained and motivated well-diggers, who would be able to work independently, provided that they would continue to be supplied with materials and equipment.

Further south, in Guinea (Conakry), a relative trickle of support from 1979 went to the National Water Supply Company, SNAPE (Service National d'Aménagement des Points d'Eau). Only in 1985 did this begin to grow to more sizeable proportions for a variety of types of installations, including both dug and drilled wells with handpumps, and in mountainous areas such as the Fouta Djallon, spring protection. The funding came largely from UNCDF (United Nations Capital Development Fund) and the European Development Fund.

Sierra Leone: during the 1970s considerable water well digging campaigns had been undertaken in the north and the west (Kenema) in close co-operation with World Bank-funded agricultural developments. Project support was provided by UNTCD specialists (Robert "Bob" Friedman and Damian Gagnon) with one UNICEF Project Officer, Bill Fellows (now in Southern Kordofan, Sudan). This continued well into the 1980s with increased elements of health education and sanitation.

In neighbouring Liberia, a similar programme continued with a continuation of the water well drilling with light-weight equipment. The Republic of the Ivory Coast was left out of the scope of water and sanitation, as far as UNICEF was concerned. There was anyway in the

late 1970s a major turn-key project for water well drilling and handpump installation with bilateral French assistance. It resulted in thousands of wells in the "Boucle du Cacao" some hundred kilometres inland from the coast. This led to the formation of a national rural water supply organization with its own personnel, budget and equipment.

In Togo a limited activity was to begin only by 1986. Benin, however, had a solid programme for wells and handpumps going on since 1980. The first UNICEF project officer, responsible for the inputs there, was Christian Hubert, the French hydrogeologist, who now is the UNICEF Regional water and sanitation Adviser for all of West Africa. With him worked the Netherlands Master Driller Willem Heijstek, previously with the Aqua Viva organization of Mali (headed by agriculturalist the Reverend Père Bernard Verspieren). Heijstek later went on to Kampuchea for UNICEF. Hubert was succeeded by Afghan hydrogeologist Mohammed Yacoub and, in 1986, by the Canadian geologist Leo Goulet, the pioneer from Nepal and Vietnam.

The Benin programme or rather project, centers on the old Dahomeyan royal court city of Abomey. It was originally a straight-forward water well drilling programme of the Indian type with India Mark-II handpumps of Mali manufacture (EMAMA in Sikasso) installed. A few of the wells by lucky geological circumstances are in artesian aquifers (water-bearing layers), in which the water rises to above the surface by its own pressure, thus eliminating the need for any pumps. In 1985 the addition to the UNICEF Project Staff of a sanitation specialist from the US, Bill Lawrence, brought with it a broadening of the scope to more sanitation and links with the PHC system. Other UNICEF staff for the drilling and mechanical maintenance training remained in Abomey, Messieurs Charrière and Lafon, both from France with most of their life-time experience from Africa.

A final recent salute to the effectiveness of the inputs in Benin, which for some period already partially had been funded by the World Bank, was the decision by USAID to channel considerable funds for the continuation of the handpump and sanitation programme through UNICEF, and link a new major USAID component of health education to this.

Further south, the Republic of Cameroon, in its central-northern parts received UNICEF assistance to water well digging, for several years with the training assured through a Belgian construction supervisor, Jean Libert. The Republic of the Congo (Brazzaville) received only minor contributions to spring protection and a few small piped schemes.

Zaire, after the UNICEF co-operation with spring protection cum gravity feed schemes in Kasaï Oriental, Kivu and Equateur during the 1970s, for a while saw the activities wane until 1984, when a French hydrogeologist, André Vandenberghe, became the UNICEF waterman, and could begin planning with the national authorities. The recent forming in 1985 of a National Water Supply Commission, headed by the Director-General of the Urban Water Supply Corporation, REGIDESO, Citizen Tchongo, and the continued co-operation with the Rural Water Supply Division of the Ministry of Local Development under its Director of many years, Citizen Sowa, lead to the formulation of a first national water resources plan for the entire country, to be approved by the National Assembly in

mid-1986. Several external donors were expected to assist different parts of the country, with UNICEF scheduled to undertake the support to water well drilling - again in artesian formations, no pumps assumedly needed - in the centrally located Bandundu region, and spring protection with gravity feed schemes in Kasaï Occidental and Kivu.

Angola had had its first assistance from WHO's and UNICEF's side from 1976 onwards. The first projects were for the rehabilitation of the water supply systems in the "fundas", the large old Portuguese plantations, which now were to serve as resettlement areas for the refugees and displaced persons from the liberation struggle against the Portuguese. Up to 5,000 persons were supposed to be served by each of these installations. For this purpose, the WHO sanitary engineer, Samuel Castrillón, designed small water treatment units of concrete, which were prefabricated in Luanda and could be transported on trucks to the project sites, mainly for the use of surface waters.

From his home country, Mexico, Castrillón recommended UNICEF to employ a Project Officer to continue his work with the treatment plants. This was Rafael Diaz Diaz, who later became Chief of the WES Section in Colombo, Sri Lanka. Soon it became evident that the small treatment plants were not sufficient to fill the overall needs of the rural population. Therefore two rather large down-the-hole hammer drill rigs were procured by UNICEF with funding from Swedish SIDA, brought to Angola and set in operation by Gustavo Aliaga, who in the meantime had moved over from UNTCD in Guinea Bissau. He was joined in Angola by a Canadian Master Driller, Earl Eldstrom, and three Portuguese specialists - the hydrogeologist Manuel de Morais and Master Drillers, Manuel de Araujo and Vasco Antonio Almeida. They work to this day under often very dangerous circumstances with the constant state of active warfare in the south of the country, roads strewn with landmines and the threat of ambushes and the destruction of lives and equipment. The present Chief of Water and Sanitation with UNICEF Luanda is Michel Nowacki, the French hydrologist, who had worked with UNTCD in Bangladesh and then with UNICEF in Pakistan for some years.

EAST AFRICA - From the Danakil Depression to hartebeest highlands

In Ethiopia the UNICEF co-operation with the National Water Resources Commission (NWRC) gradually moved from the Provinces of Wollo and Tigre to the more centrally located province of Shoa, around Addis Ababa. The UNICEF Representatives during the 1980s, Manzoor Ahmed and Ramaswamy Padmini , oriented the UNICEF assistance more towards sanitation and the links with child health and other basic services. One major event was the Workshop on Sanitation and Health Education, held in Jimma, Keffa Province, with participants from different government sectors, UNICEF, WHO and UNDP. It aimed at promoting the further integration of the different services and to demonstrate the strong community participation and especially the strength of the new Women's Associations.

Another significant change in the co-operation of UNICEF with the government was the attachment of the UNICEF water supply and water well drilling specialists to the NWRC, with this organization now taking a

fuller responsibility for the overall management. The UNICEF specialists, first for some years from 1980 were headed by Indur Mirchandani, former Chief Engineer of Himachal Pradesh in India, then up to present by Kalidas Ray, also an engineer from India and included Vlado Zakula and Sergio Peresutti. They remained with their hands full of work, their function became more intensely one of training and assisting in the planning and management of the UNICEF inputs.

Sudan forms a direct connection, geographically speaking between the Sahel, Ethiopia, Uganda and Kenya. The new drought hit Sudan in 1984/85 together with the influx of further refugees from Ethiopia and caused thousands of Sudanese to be displaced within their own country. The transport situation was extremely weak. To this came the upsurge of the new rebel movement in southern Sudan in spite of all attempts by the Khartoum government to provide a large degree of autonomy to the south.

The old engagements in water supply and sanitation in Bahr-el-Ghazal in the south were continued with the provision of water through the India Mark-II handpumps. By 1985, 800 such handpumps had been installed in that province and in Equatoria to the south. In 1985 and 1986, rebel action seriously curtailed the operations and some of the local authorities looked askance at the possibility that some of the well sites might benefit the rebels. Still, Joseph Maker, the Sudanese Project Manager and his team held the ground in Wau, seconded for a while by chief master driller Phil Parry.

At some recent moments in 1985 and 1986, the rebels also came close to Kadugli, where for several years Gian Bicego, an Italian-American civil engineer had led UNICEF's work with the "hafirs", the rehabilitation of rainwater collection basins and the well drilling/handpump operation in Southern Kordofan. When the rebels came close, his post had been taken over by Bill Fellows, who has strongly contributed to widening the scope of the work with an added strog element of sanitation/health education. Among other colleagues active in this bleak and remote town should be mentioned Tom McKnight, a young American who from a secure but less exciting post with UNICEF's Comptroller's Division, took the step out into the bush to work for two years as Administrative Officer with the water people. among them Petrus Smulders, Chief Mechanical Instructor from the Netherlands.

Already before the 1984/85 drought, subsurface dams were planned for the Red Sea Province. To this dry part of Sudan and to the areas further south more assistance was directed. It included a number of camps that were swelling with new arrivals of refugees around Kassala and Gedaref. Likewise, the west with Darfur and Northern Kordofan around El Obeid also were added to the areas slated for assistance.

The UNICEF project staff in the 1980s underwent several changes. For some years, the WES Chief was Sigurd Holmberg. He was succeeded by the former Head of Swedish SIDA's Water Section, Leif Rosenhall. Later for some years Leif became the Regional Handpump Adviser for the World Bank in East Asia (and in 1986 came back with UNICEF to work in Burma). His successor for some years in the Sudan, Max Madayag from the Philippines, returned Manila for study leave. His successor, in turn, is Ken Gray, the engineer from the United States, who had previously worked with

UNICEF in Yemen Arab Republic and in India. The Yugoslav drilling engineer Mladen Zelenika was transferred from Lebanon to head the emergency water supply activities.

From the difficult beginnings of UNICEF's water works in Somalia around 1980, there was a steady improvement and widening of the activities. The end of the 1970s for Somalia were overshadowed by the more or less permanent drought conditions and the warfare with Ethiopia over the vast expanses of Ogaden. Refugees from that flat semi-desert settled en masse in camps around the Wadi Shebele and other river beds that would lie dry for the greater part of the year. Their women would dig by hand, at the best with calabashes as their only tools, pitiful holes into the sands of the riverbeds, so as to collect the few drops of muddied ground water that would collect in their bottom.

Rapid action was of the essence. With the slowness of the understaffed government organizations, notably the Water Development Agency (WDA) in Mogadishu, with the difficulties encountered by UNICEF with the small means available and a host of the constraints, there were delays upon delays. These were aggravated by the long lead time for the supply of equipment and materials, such as drill rigs, casing and pumps, to get into place. Few shipping companies cared to route their ships to Mogadishu and the goods frequently were shortshipped, dotting the quaysides of Aden or Mombasa.

The first UNICEF Project Manager, Ricardo Nuñez Woitschach, a Bolivian-born Canadian, formerly a hydrogeological expert with UNTCD, had a hard time starting the work, despite the personal efforts of the WDA Technical Director, Mohammed Issa, to help start up operations. Gradually, the next Project Manager, Per Engebak, now with WET in New York, managed to set matters straight, so straight that it rendered him an additional eight months in Somalia as a very successful Acting UNICEF Representative.

The difficult groundwater conditions required a careful selection of the well sites in order to avoid the large areas underlain with waters with high salinity (chlorides and sulphates). For some years a seasoned Canadian hydrogeologist, William "Bill" Turner, saw to it that the wells drilled for refugees and the ordinary local population would guarantee the production of fresh water.

From the refugee areas in the central-southern parts of the country, the emphasis of the UNICEF-assisted water activities was shifted to the even drier north, to the region around Hargeisa, where a strong health and sanitation component was added. The senior Bangladeshi UNICEF engineer Abdul Awal was transferred from the Philippines to supervise the action together with the Liberian sanitary engineer Hylton Parkinson.

More a curiosity now, a pilot project for desalination of sea water was carried out in Somalia around 1979 with the installation of a solar distillation plant. It was to work according to the greenhouse principle of having sunlight heat up a shallow basin with sea water under a roof of glass panes. The fresh water would evaporate and condense against the underside of the panes. The droplets would run off into inside gutters and eventually collected. The plant was to serve a population of about

1,000 people with drinking water. It was built in co-operation with UNIDO, who had as their consultants the Chemical and Marine Salts Ltd., a Government of India enterprise in Bhavnagar, Gujarat, India. This desalination plant was located on the coast, south of Mogadishu, close to a village populated by a group of the 122,000 nomads who had been airlifted from the north of the country by the Soviet Air Force during the drought in the 1970s. The nomads meanwhile had been settled by the ocean and trained to become fishermen. After initial difficulties in maintaining the solar plant, with baboons thrashing through the window panes at night, three watchmen were employed to prevent a recurrence of such destruction. That notwithstanding, the solar distillation plant never gained much popularity with the villagers and ended up providing water for the local cannery.

Further south, in Uganda, immediately after the fall of Idi Amin in 1982, a major operation began for the rehabilitation of water wells. Uganda, along with Kenya and Tanganika before their independence, had been one of the few colonies where rural water supply through drilled wells and handpumps had been instituted on a large systematic scale from the 1930s on. Two major contracting firms, based in Nairobi, did the drilling and construction work. One was the Craelius East African Drilling Company (CEAD), an affiliate of Craelius (later Terratest AB) in Sweden. The other one was Mowlem Ltd., the affiliate of a major British engineering group.

Both companies trained local water well drillers. The Swedish drilling supervisors of CEAD came up with the design of one of the first VLOM handpumps in the world, the "Uganda" pump, built from standard pipes and fittings with a heavy handle of local mahogany. If the handle broke, the villagers could just go to the nearest forest and cut themselves a new one. At the advent of the dictator Idi Amin, in the beginning of the 1970s, some 10,000 wells with handpumps were serving large parts of the rural populations. During a decade and a half of political repression and terror with the ensuring mismanagement and neglect of the country, a large number of these wells fell into disuse or were wantonly destroyed outright through war action or vandalism.

A huge task therefore awaited the UNICEF team, when in spite of continued rebellions and marauding bands of soldiers and tribesmen, the programme for the rehabilitation of these 5,000 wells was formulated. It includes the drilling of additional wells, an incipient drive for sanitation with excreta disposal and the integration with the primary health care programme and the campaign for Child Survival and Development with immunization. Much of the work concentrated on the dry Karamoja region, with a base, workshops and all, in Soroti.

The Uganda water and sanitation team for some duration now has been headed by the Swede Thomas Ekvall, who could draw from his long experiences in Ethiopia. Other UNICEF colleagues include the Australian drilling engineer Anthony Espie, Rudolf Palo (Sweden), the Irish Maintenance Engineer Brendan Doyle, Pump Installation Supervisor Zeruba Beta Kasangalis, Paul Bernard Beni and Michael Cornell, Steven Lee Hawley and Evert Jansson.

The small republic of Djibouti, nestled around the southwestern corner of the Red Sea, is part of the hot Danakil Depression. It is also called the "Afar Triangle" by the geologists, the only people to relish the otherwise barren basalts and other ocean-bottom features on dry land there. With UNICEF's assistance, the first effective campaign for rural water supply was launched in 1980. A young U. S. water well driller with a background in business administration, Ed Martin from the Acadian part of Maine, in that year plunged right into the water problems of small, scattered and extremely poor settlements. This campaign during the years won high acclaim from the Djiboutians. Even the President of the country himself came to inaugurate some of the well sites.

Kenya, since it independence in the 1950s, received a considerable measure of bilateral aid. UNICEF's water and sanitation inputs in this country never were very large. The most interesting part of work done by any United Nations organization, is the development of programmes of the last few years, involving the women's advancement as connected with water and sanitation. This is managed by UNDP with substantial funding from the Norwegian government. UNICEF co-operates closely with this programme, headed by Ms. Sarah (Sally) Timpson of UNDP. It covers several countries in the Americas, Africa and Asia, with some of the components being co-ordinated with other UNICEF support to water and sanitation programmes.

Although also Tanzania for many years has been subject to massive bilateral aid, the size of the country and the problems of services to the widely spread population are so large that many years of work still lie ahead. The government has an entire Ministry of Water, "Maji", in order to study and manage the scarce water resources of the country. For channelling and co-ordinating the external assistance to the country, the several major external organizations, including several bilaterals and UNICEF, each have been allotted a geographical part of the country in the form of major districts. UNICEF thus at the end of the 1970s, was allotted the water supply of the Iringa District, concentrating on the Wangingombe Project. This is situated in the southern-central parts of the Tanzanian high plateau and consists of a network of pipelines, totalling over 250 kilometres in order to cover the number of villages that could not otherwise be supplied with any water - no groundwater resources exist in the unusually dense rocks of this area. The water for the scheme comes from a group of productive water wells at some distance from the project area to be supplied. In this particular case, the community participation element was always extraordinarily strong. The work is also strongly backed-up by the community and political spirit fostered by the Ujamaa Movement. During the last several years of the 1980s, the project has been combined with a concerted effort to increase the level of rural sanitation. From UNICEF's side for many years up until now, the moving force has been Ivan Blakely from the U.K., later with the Swedish Engineer Roger Andersson as technical advisor out of Dar-es-Salaam.

Two countries, which for the sake of their geographical situation and physical conditions rather should have been mentioned together with Zaire, being situated on the eastern rim of the great African Rift Valley, are Rwanda and Burundi. The largest part of their water resources are easily available in the form of natural springs, which

since many years back are being provided with protective masonry. In many cases, as in other hilly and mountainous countries, pipes conduct the water by gravity to the villages. A large part of the work is dedicated to training local craftsmen to handle the masonry and plumbing work. In both countries UNICEF did the work to some degree more operationally than it normally would have done, partly in parallel with another organization, the Belgian AIDR. UNICEF's Project Officer for Rwanda for many years was a Belgian geologist, Claude Massar, who very recently moved to Rwanda in the north, being replaced by Yves Faugère in Burundi.

Malawi lies in the southern continuation of the African Rift Valley. In some cases, natural springs could be used for water supply of the villages. The largest part of the rural water supply, however, has to rely on groundwater with drilled or dug water wells and pumps. At the same time this country had seen intense efforts to improve the primary health care system, with the ensuring health education. Traditionally, Malawi has been a kind of model country for e.g. agricultural extension. Campaigns for both improving the agriculture with the existing very limited financial means and water and sanitation have been successful, partly apparently due to traditional village structures, knowledge, attitudes and practices. A strong bilateral input, particularly from ODA, the U.K. Overseas Development Agency, helped to build up the capacity of the Ministry of Land and Valuations, with the successive training of Malawian counterparts through mainly U.K. specialists. As of the time of this writing, the department is now completely in the hands of Malawian administrators, geologists and technicians. UNICEF assistance concentrates partly on the poorer parts of the lower Livulezi Valley with continued support to self-help schemes. In the fall of 1986, UNICEF placed John Rodolfo Townsend as adviser to the programme in Malawi.

Zambia has had very small inputs from UNICEF. There is some bilateral aid, mostly handled through engineering firms from the donor countries on contract.

From 1981-82, following its independence, Zimbabwe, received technical assistance and promotion of the close linking of water and sanitation with the health parts of the government development programme. Most of UNICEF's assistance went into the drier, rockier and poorer parts of the country in the west, into Matabeleland. The UNICEF Project Officer is David Williams, a U.K. sanitary engineer who for most of the time was based in Bulawyo in the East and only recently moved to Harare. He could build on an interesting health infrastructure with enthusiastic and energetic health workers.

Throughout the years, Botswana received some modest allocations from UNICEF, mostly for piped water supplies from boreholes for the unusually large villages, which often would have between 20,000 and 30,000 inhabitants each. The main part of external assistance to Botswana in the 1980s was to a large degree taken over by Sweden, which is why UNICEF never developed its water assistance further there.

In the two landlocked countries of Lesotho and Swaziland, it was Swaziland that received the lion's share of UNICEF's assistance for some four or five years, until three years ago, when the Canadian Government, through CIDA, took over the responsibility for most of the external aid.

The first attempts to assist rural water supply in Swaziland from the side of any United Nations organization, was by UNEP. The emphasis was on a pilot scheme in a very small areas of 10 x 20 kilometres, immediately north of the southern border of the country towards South Africa. The objective was to try to eradicate schistosomiasis through improved water supply and sanitation to the mostly single-farm households, the so-called "homesteads". The measures were to include the construction of shower stalls and laundry facilities for the individual households, in order to prevent the villagers and their children from going back to the contaminated water courses. Through UNEP, UNICEF was included among the donors and gradually the responsibility for the support went over to UNICEF.

This programme was beset by a number of problems and did not reach its objectives. The one positive thing about it though was that it accelerated, sooner than foreseen, the forming by the Swaziland government of an independent rural water supply division, which would have the work done with in its own management and with better results.

Lesotho has an on-going sanitation programme under the supervision of the UNDP/World Bank Global Project for Low-Cost Sanitation. This involves particularly the construction of pit latrines. The country is also in great need of securing its water supply, because of the total dependence of Lesotho for its energy from import of electricity from South Africa. Some discussions have been held about the possibility for UNICEF to assist also in funding part of a larger power plant for the purpose, particularly in the light of recent contretemps politically between Lesotho and its mighty South African neighbour.

From the last years of the 1970s, Mozambique received considerable support from UNICEF. The assistance was, to a large extent, directed to the northern-most region, inland of the port town of Pemba. Here, the Makonde Plateau extends across the border with southern Tanzania. Its inhabitants, one of the most artistic populations in Africa, famous for their wooden sculptures, live on top of the plateau, off the vector-infested river banks and creeks. The problem was to provide water from safe sources in the lower flanks of the slopes by pumping it up to the plateau. This is where UNICEF's first Project Officer in Mozambique for water and sanitation, Dr. Joseph (Joe) Christmas developed a series of piped systems. At a later stage, simple water supply and sanitation systems around the capital, Maputo, were developed and more are planned for. The task ahead is very great. Large areas in the central parts of Mozambique during the more than ten years since independence in 1975 have not been accessible because of guerrilla action. Once - hopefully soon - they should arrive at more peaceful conditions. The present UNICEF Water Chief, Steve Radojicic will then be facing an even greater challenge with the large size of the country and the tremendous need for building up the basic services everywhere.

There is a potential for further development of water and sanitation activities in Madagascar where the inputs up to now have been at a very low level. On the Comoros larger assistance during the last years was provided by UNTCD with UNDP funding.

Middle East and North Africa - the widening scope

With the exception of the Sudan, and the Yemen Arab Republic, the UNICEF participation in water supply and sanitation in the Arabic-speaking countries of the Middle East and North Africa did not accelerate until 1980-81. A wider scope for both funding and policy promotion was opened, partly through the U.N. system promotion of the Water Decade, partly through the initiative of UNICEF's Executive Director, through his personal connections with a number of fundraising and funding organizations in the Middle East. This includes the personal inputs by His Royal Highness, Prince Talal Bin Abdul Aziz of Saudi Arabia, to solicit funding from several of these organizations for UNICEF assistance in water and other activities. In some cases it resulted in supplementary funds, considerably adding to the generally more limited allocations from general resources. In other cases it stimulated low-interest loans for rural water supply and sanitation from some of the major regional financing institutions. Among the contributors were: AGFUND, the organization that Prince Talal, for several years one of the official UNICEF Ambassadors, had set up for funds sought from various Gulf State and other sources, the Arab Fund for Economic and Social Development (AFESD) and the OPEC Fund.

Lebanon received a major share for the continued rehabilitation of Southern Lebanon, which was phased out in 1985. In Egypt a major input began in 1981. A number of water supply projects to large villages, all the way up the Nile Valley between Om Kombo and Aswan, drew from water wells drilled for groundwater with electrical pumps, small elevated tanks and piped systems to standposts and possibilities for house connections. Gradually for smaller agglomerations and outlying villages, also the India Mark-II handpumps began to be installed. - In Northern Sinai, a major water well drilling programme was launched at the insistence of the Government of Egypt. Some of the depths to fresh groundwater were expected to over 1,000 metres (over 3,000 feet) which required the procurement and use of heavy drilling equipment, more in the style of oil well drilling. Funding for this remote and desert-like area was provided generously from Italy with the special master drillers and drillings superintendent being recruited from the same country. The overall co-ordination from UNICEF's side for all this work during the last four or five years was provided by the Yugoslav drilling engineer, Vlado Panic, seconded by the Egyptian civil and hydraulic engineer, Magdi Zaki.

The great concern for environmental sanitation, and in particular excreta disposal, also was attended to, although, in most such cases this has taken a much longer time to really be rooted in the UNICEF assistance. The difficulty was the usual one of the great need for long-range preparation of public awareness and the difficulty to find proper means to influence the habits and beliefs of the villagers. During the end of the 1970s, UNICEF assistance was requested for tackling the great question of drainage in large villages and towns in the Nile Delta. The problem of getting rid of excreta and other wastes in these very low-lying and from time-to-time flooded areas, could well be imagined. With the magnitude of these problems, UNICEF never got around

to doing very much about it. Some parts of the Delta, especially the region around Alexandria, at any rate was subject to World Bank funding. Also, in later years, major contributions to mainly urban water supply were provided from USAID to Egypt.

The activities in both Yemen Arab Republic and the People's Democratic Republic of Yemen already were discussed in the previous chapter. They continued into the 1980s. The supervision of the work in Yemen Arab Republic was taken over around 1982 from Mr. Shatby by Rajaratha Pandian, an Indian engineer who had previously done the same work through UNICEF in the south, based in Aden.

A special input was made in 1984 in Yemen Arab Republic for the city Dhamar and its nearest surroundings, which were heavily damaged in an earthquake. The UNICEF work there was particularly taken care of by a Nepali engineer, Prahlad Manandhar.

A new country on UNICEF's water and sanitation map is Oman, where certain inputs for rural water supply are still in the planning stage. - At the western extreme of the Maghreb countries, i.e., in the northwestern part of the African continent, Morocco had continued and accelerated coverage of rural water supply with partly UNICEF-assisted dug wells with handpumps and intensified village sanitation. The presence for the last five or six years of an experienced French sanitary engineer, Mr. Bernard Gilbert, helped very much in this strongly community-oriented activity, which as one of its by-products may in the long run serve to promote women's advancement in many of the traditional societies in the Atlas Mountains.

Likewise with the partial aid of supplementary funds from Arab financial sources, UNICEF provided assistance to Tunisia during the 1980s in an area of poor rural communities around the old Arab cultural centre of Kairouan. Another UNICEF Project Officer, Robert Larsson, was stationed here after a number of years with UNICEF in Niger.

Asia - women's advancement

Although the African continent demanded even higher priorities, Asia continued to carry the weight of the UNICEF water and sanitation statistics. The population increase continued and with it the problems of food and malnutrition (so far offset through the effects of the Green Revolution), of shelter, of the environment and of water and sanitation. There are, however, also many positive trends and highlights in the warp and woof of recent history of development in Asia.

The emergence of some of the Asian nations as highly industrialized, higher-income countries with a definite improvement in their quality of life and consequently in the state of their children is an encouraging phenomenon. The lead was taken by Japan, placing itself in some respects even ahead of the other OECD countries, with a technology anticipating the 21st century. Japan had become a donor country with good potential. Japanese trucks, machinery, equipment and other supplies have become a factor to reckon with in water supply and sanitation around the world. A

specific place in the development of social and economic factors in low-income communities, was taken by JOICFP, the Japanese Organization for International Cooperation in Family Planning, which has water and sanitation as a component of its promotion of community health through family planning and parasite control. Recently, the Japanese International Agency seems to take a much more active stance in the field of water supply and sanitation, benefitting from the great experience of its sanitary engineering adviser, Mr. Kunitoshi Sakwai, who formerly worked with CEPIS in South America.

The other and younger high-technology nations and enclaves in Eastern Asia also came to play a role for supplies and as entrepôts for the logistics, mainly Hongkong, Singapore and the Republic of Korea ("South Korea"). In the last mentioned country, UNICEF in 1980 had phased out of assistance to rural water supply and sanitation, a successful activity during the 1960s and 1970s. This as well as other infrastructural activities have completely been taken over by the Koreans themselves.

Another country with greatly improved living conditions and complete planning and implementation on its own of its services is Malaysia, where early in the 1980s the last supplies were delivered, especially for the Borneo part of the country. Energetic management on the national side by people such as the Director-General for Water Supply and Sanitation, Mr. Rajasekarasekaran, contributed along with strongly national support from the side of the government.

In the Philippines, some modest assistance in terms of supplies and support to Human Resources Development continued, after UNICEF's Water Adviser to the Rural Water Supply Programme, the Bangladeshi engineer Abdul Awal had left. Upon his departure he was greatly honoured by the government with a special citation for his knowledgeable and well received work.

The large country of Indonesia, with its many islands and 5,000 kilometres from one end to the other had the UNICEF co-operation further strengthened. A small UNICEF support unit in Jakarta was headed for much of the 1980s by Mesbahuddin Akhter, who later was joined by Zahirul Karim, both engineers from Bangladesh, and Per Engebak, who worked particularly with groundwater technology.

The People's Republic of China, which has seen a remarkable development, particularly after 1976, still has to fill enormous needs for improved water supply and sanitation in different parts of the country, including the large cities. Many outlying areas are as yet underserved, either in terms of quality or quantity of water or both. For many regions, handpumps are the only solution. It is not a coincidence that in the early 1980s the government of China began a co-operation with the UNDP/World Bank Handpump Testing and Development Project and built up two handpump testing laboratories, one in Beijing at the Chinese Academy for Agricultural Mechanization Sciences, the other one in Changsha, Hunan Province. Some of this work will serve handpump development for drinking and household water supply, some for irrigation purposes.

UNICEF is not directly involved in this work (in which the health links are assured through the National Patriotic Health Campaign). It is nevertheless mentioned here as an indication of the magnitude of the water supply problem, which reputedly even in Beijing causes the city water supply system to be supplemented by 40,000 handpumps. These now run the risk of being rendered inoperable through overpumping of groundwater with larger and deeper-set power pumps.

In principle, UNICEF would not go into any assistance to low-cost water supply in China. The magnitude of the needs are far beyond any capacity that UNICEF could muster. If the problems of rural and peri-urban water supply were to be approached on the scale, say, of the India village water programme, a total investment of $10,000 million would not seem unrealistic for, say, an initial five-year period.

The Good Daughter-in-law
by Hsieh Chang-yi

"Early in the morning, the magpies cry,
The newly-wed daughter-in-law is carrying excreta on a pole
Liquid from the excreta stains her new trousers
The hot sweat soaks into her embroidered jacket
The commune members praise her and mother is pleased
All tell her she has got a good daughter-in-law."

Consequently, it was quite exceptional when during the Fall of 1985, UNICEF began to plan for limited support in the form of materials to one single rural water supply project in Lunan county in Yünnan province, 130 kilometres southeast of the city of Kunming. Here, a population of Yi, a specific "nationality", and Han people of 70,000 inhabitants, would be provided with water from already existing dams through pipelines, to be laid out in the water-poor Karstic limestone areas. The UNICEF input in this case serves to illustrate an essential public health point of a demonstration nature in an "Experience Exchange Project" of high visibility.

The sanitation problem will be taken up in this context. The needs for great improvements in the practices of excreta handling are there but require equally great care in planning for any changes in knowledge and attitudes. For UNICEF, any involvement in sanitation in China will be a matter of the future with small means and little personnel resources.

The Indochina Peninsula attracted new world-wide attention, when in 1979 the Khmer Rouge forces of Pol Pot were driven out of the larger central and most populous parts of Kampuchea by national and Vietnamese troops. The extent of the destruction and mass killings by the Pol Pot forces shocked the world and triggered one of the most concerted relief efforts in history, effectively co-ordinated by UNICEF from 1979 to 1981. The emergency action was then phased over into more regular programme support.

Water and sanitation would have to wait until 1982, since food, health, transport and other more immediate aid had to be taken care of first. The first question was one of helping the scattered, shattered and decimated Cambodians to survive and then to rebuild their society and its institutions. Logistics that were needed on a large scale, were extremely limited through the difficulties of access, the scant port facilities and the absolute neglect of the road-net and the waterways.

The first programming for water supply had to limit itself to repairing and starting up afresh of the individual systems for hospitals, schools, orphanages and teachers' and health workers' training centres in the capital, Phnom Penh, and in the district capitals such as Battambang and Takeo. Two small cable tool rigs had been brought into the country as generous gifts from the workers of a U.K. manufacturer of drill rigs, Duke and Ockenden (DANDO), in order to be used for the first drilling of wells for handpumps installation in the countryside.

This first phase of the work was taken care of for the first two years by a French master driller cum mechanic cum electrician, Mr. René Guillaume. Since 1984 the Netherlands water well drilling specialist, Willem Heijstek, and a compatriot of his, the hydrogeologist Hans Spruijt, took care of somewhat expanded activities, made possible through the advent of stronger and more rapid drilling equipment. Much remains to be done until full national capacity will have been reached in order to provide adequate services to this country which had been so utterly ravaged by war action all the years back to 1970.

In Laos the well digging and latrine construction activities were considerably expanded from 1980 on, also to other parts of the country with the opening up of the entire area of this country for UNICEF assistance.

In Vietnam the sanitation activities continued with the construction of the double vault latrines. Water supply went from the urban interventions of the 1970s to a much more country-wide input for true rural water supply with a great element of water well drilling and the installation of handpumps with an extension of these services to southern Vietnam. For five years, until late 1985, these activities were headed by Leo Goulet, formerly in Nepal, and now in Benin. Working together with his Vietnamese counterparts and with UNICEF's drilling engineer

Zafar Rana from Pakistan, and Abdul Kalam, a number of systems were created which were both safe, much less costly and easier to operate and maintain for the villagers than many of the piped schemes. The drilling operations were particularly applied to areas where there were difficulties to dig water wells in the traditional way. An engineer from The Netherlands, Dick van Ginhoven, takes care of the sanitation aspects.

In Thailand, UNICEF continued with sizeable programme inputs. To the west, Burma had had a spectacular increase in its rural water supply activities through the Dry Zone programme, with eventually over 5,000 deep wells sunk from 1976 through 1985. After delivering eleven large drill rigs and other supplies for these operations, including compressors for the air lift of water as well as other mechanized, power pumps, UNICEF phased out of this programme during 1985. Instead another major programme was begun with the Ministry of Health in another part of the country, principally the three southern provinces of Rangoon, Irrawaddy and Pegu. In the soft soils there, with the water table close to the surface, it was easier to have wells and sanitary latrines constructed by the communities themselves. This whole work was closely linked with the existing political and administrative structure and the other components of a major health development in Burma.

In the Chin Hills northwest of Rangoon and west of the Irrawaddy plain, around a town named Tiddim, work continued on piped water supplies from natural springs. The UNICEF assistance to these programmes was managed from Rangoon by Steven Allen (U.K.), a UNICEF programme officer, who took care of both the health as well as the water and sanitation aspects of the programmes. For some years, UNICEF drilling superintendents assisted the Rural Water Supply Department in the training of Burmese engineers and managers in the dry zone programme, the assistance to which gradually was taken over completely by the Australian co-operation (ADAB). This was one of the clear cases where UNICEF, after assisting in the original organization and start-up of a major, highly mechanized water well drilling programme, could leave this to the country's own authorities and human resources. Continued assistance was secured by ADAB as a major bilateral agency, while UNICEF itself could go on to less mechanized, more community-oriented programmes with more immediate links to primary health care.

On the Indian sub-continent and in adjacent nations, the water and sanitation work continued. There was a definite trend towards increasing and fuller commitments on the side of the different governments. This was further stimulated through the promotional action of the International Drinking Water Supply and Sanitation Decade. At the same time, in all of these countries, the sanitation and health education components were introduced with increasing success.

In Pakistan the activities in the different parts of the country were considerably broadened in the different provinces. Baluchistan, in the southwestern part of the country, had the so-called BIAD programme (Baluchistan Integrated Area Development) with the provision of water supply and sanitation to a number of large villages in a very dry setting. From UNTCD, UNICEF took over the drilling superintendent, Rosauro Moreno, from the Philippines. For some years, until 1985, a senior Swedish engineer, Mats Ahnfors, was in charge of the technical

part of the operation. In Sind, apart from the work on the latrines in Karachi, a modest continuation was made with the programme in the northern parts of the province to the west of the Indus River.

In Northwest Frontier Province, in 1980, the major influx of refugees from Afghanistan began. An estimated 2-1/2 million people settled in the border zone with Afghanistan. Initially they had to draw some of their water supply from existing wells. In many cases water had to be trucked in with water tankers. Thirty of these were provided as a gift from AGFUND (Prince Talal) through UNICEF. As this was a very expensive project, attempts were made to provide water from other sources, such as drilled wells and public standposts on pipelines, supplied from further away water sources.

The great innovation in Pakistan was the training of some 400 village promotors for water and sanitation for health that was carried out for four years, during the period 1982 and 1986, eventually at the facilities of the government Training School for Community Management at Lala Musa, halfway between Islamabad and Lahore. This was one of the more spectacular successes of UNICEF. It was not only the question of training village promotors. A most important element was the incipient advancement of women and to have women for the first time participate in this particular kind of activity. There were a great many constraints. For one thing, women were not supposed to work together with men, whereas the ideal system was foreseen to have a man-woman team working in each village. Some of the young female students in these courses, at first came to the Lala Musa school, accompanied by their parents for safe measure. Also, the matter of excreta was not supposed to be talked about in the Pakistani villages. The results, after some years of these courses, were spectacular, not to say startling. The self-assurance of the young, once very timid ladies, was extremely encouraging to witness and the potential of their personal development was clearly visible. The problem was to prepare the government to take over the costs for the salaries of these promoters. By the end of 1985, this was still somewhat uncertain, although it seemed that the provincial and federal governments were very positive to the idea. It therefore, at the time of this writing, remains unclear whether UNICEF would be able to continue with this component.

A water supply and sanitation section in the UNICEF office in Islamabad is supervising and monitoring the UNICEF inputs. This was headed, during the first years of the 1980s, by Michel Nowacki, the French hydrologist who later went to Angola. His successor was a Swedish engineer, Ingvar Wiberg, with his previous extensive experience particularly from many years of evaluations for SIDA in East Africa. The training of promotors and health educations aspects were in the hands of Margarita Cardenas and Chit Chaiwong, jointly with Pakistani colleagues, notably Ms. Mahmooda Jilani and Mohammed Aftab. The work in the Northwest Frontier Province was handled first by a Polish drilling engineer, Tadeusz Ciurczynski and later by John French, a British drilling engineer with his previous experience from the Norwegian Church Aid in Sudan. The overall responsibility for all the UNICEF activities in Baluchistan was eventually taken over by Ken Gibbs, the U.K. engineer who for several years headed the Bangladesh WES Section. Ken Gibbs'

broad and public health-oriented experience makes for good backstopping for the work in Baluchistan, where a major reorganization of the work was initiated in 1985.

In India, with the 1980s, there came a much greater diversification of UNICEF's work and a great expansion into the realms of sanitation, health education and community motivation. The Government of India continued and increased its own share of the funding and, with the state governments, the management of the water well cum handpump installation operations. Eventually during the last years, in the mid-1980s, the Government of India budget for the rural water supply programme amounted to about US$ 650 million. Presently there are a total of some 3,000 high speed drill rigs in the country, not counting machinery of other types, and the thousands of engineers and drillers involved. The handpump industry, with the manufacture of the standardized India Mark-II handpump, has over 40 manufacturers authorized to deliver their products to the different states. It means that these manufacturers have agreed to follow the standards and submit to regular control of the deliveries. This industry is estimated to employ more than 8,000 people in different parts of the country. Every state is now preparing to have some handpump manufacturing capacity of its own.

UNICEF funding was considerably reinforced through several millions of dollars annually contributed, especially from Swedish SIDA, who also seconded a Programme Officer of their own to the UNICEF WES section in New Delhi, in order to take care of monitoring and evaluation. Until very recently this was Bo Elding, who launched some of the most elaborate evaluations of any handpump programme anywhere in the world, taking into account that the handpump installation also represents the largest effort anywhere of this nature. The UNICEF inputs during the last several years have shifted considerably from the wholesale delivery of drill rigs to still keeping up the delivery of spare parts. Large portions of the funding go to the "software" aspects, particularly the training of handpump caretakers. In a previous chapter the maintenance system was described. The village handpump caretakers have the principal role for the maintenance and minor repairs of the pumps. In spite of brave UNICEF efforts to have the State organizations take over full responsibility and broaden the scope of training of such caretakers, UNICEF still finds itself somewhat alone or not as much followed as would have been desirable until now. As a result, for instance, in Andhra Pradesh in 1984 only 6,000 caretakers were trained, whereas the total number of India Mark-II pumps installed in that state alone amounted to to 86,000.

The Chief of the Water and Environmental Sanitation Section in New Delhi, during most of the first half of 1980s was Marcello Bevacqua, the cosmopolitan Swedish geologist with his roots in Italy. He was succeeded by Mesbahuddin Akhter, the Bangladeshi engineer, who prior to that had been chief of the water section in Indonesia. Water well drilling continued to be in the hands of Rupert Talbot, after an interlude for him of a couple of years around 1980 in Sri Lanka. With Talbot, a number of drilling engineers and master drillers, including Clemence Doku from Ghana (Puna), Colin Davies (Bhubaneshar) and Kenneth Mason (Calcutta) from the UK, were working particularly with the training of national counterparts. Ken Gray, a U.S. engineer, for many years co-ordinated UNICEF's work on handpump in India, before being transferred, in 1986, to

Sudan. An increasing role was played in this work, as well as the overall care of water and sanitation with a strong element of community motivation and handpump caretaker training, by the UNICEF national colleagues from India. Some of them, like T. K. Kanagarajan in Tamil Nadu and Andhra Pradesh, proved to be magnificent communicators and as good for arranging for health education as for tending to water well drill rigs.

The new and growing activities for sanitation and generally improving the hygiene in the poorest communities, frequently populated by harijans, remained headed by Philip Wan, a civil and sanitary engineer from Mauritius, together with Dr. Tieu-Vuong Luong and Y. D. Mathur, an Indian colleague and specialist for sanitary engineering and sanitation. The training and community motivation aspects of this part of the programme were taken care of by Eugene Leonenko, an educator from the Soviet Union, who continued and broadened the development of methods and training and educational materials for use in both villages and the peri-urban areas.

In Nepal a strong programme component of shallow tube wells with suction handpumps of the same type as in Bangladesh was introduced to the Terai plain. Sanitation also began to be more widely promoted with the construction of demonstration latrines together with all the water supply programmes, whether in the higher reaches of the Himalayas or out in the lowlands of the Terai. Special attempts were made in a pilot project in a small town near Kathmandu to clean up the whole town's environment and stimulate the town dwellers to better hygiene. This part of the work was closely supervised and much stimulated through a young U.K. sanitary engineer, Ms. Vanessa Tobin, who was readily accepted by the townspeople since she was known by the Nepalese for several years, speaks the language fluently and dressed as a Nepali woman. Her methods of motivating and educating were very innovative, including block to block contests as to which part of the city would be the cleanest. Vanessa Tobin's good work is now continued by public health specialist, Ms. Wee Ling Ooi from Malaysia.

The Chief of all these activities from UNICEF's side for several years was Colin Glennie, a British engineer who had over ten years of working experience with piped water schemes in Malawi, working together with the famous Lindesay Robertson before joining UNICEF. Glennie was transferred to Bangladesh in 1985 and succeeded by Larry Robertson, a U.S. civil engineer with many years of experience in Nepal. Among the other colleagues, some eight or nine of whom are stationed in small farms and villages in remote locations along the edge of the Himalayas, could be mentioned Henk van Norden, Erik Baetings, Niranjan Shrestha, Thomas Ebersoll and Prem Subba. Several of the Nepalese government engineers and UNICEF national officers were transferred to international posts in other parts of the world, in order for UNICEF to draw from their great experience, especially with spring protection and gravity feed systems under difficult conditions.

The Bangladesh programme continued in good strength during the 1980s. The Chiefs of the WES Section in Dhaka, Ken Gibbs and Colin Glennie, worked and continue to work with a strong team of specialists such as the civil engineer Stanley Hall from Jamaica and Jahangir Kabir from Bangladesh.

Sri Lanka - pumping iron

Around 1980, a first pilot programme for water well drilling in the hardrock areas covering most of Sri Lanka was started up around Hambantota in the south. It was intended to show the feasibility of the India type of handpump programme. Although there were some problems with the high salinity in some of the borewells, it was deemed successful enough to warrant a continuation on a larger scale. This was carried out in the north, around Anuradhapura, later further east, and in the Kalutara District southeast of Colombo. Eventually wells were also drilled in parts of the area for the Mahaveli Ganga irrigation scheme.

In the granite hill country around Kandy, for the extremely poor tea plantation workers and their housing, the "lines", it was necessary to improve their water supply and sanitation situation. This was done through gravity feed schemes (pipes) from natural springs. One brave attempt was made to experiment with horizontal drilling, but the only equipment available reached only 20 - 30 metres into the cliffs, which was too little.

The WES Section in Colombo for some years was in the hands of Yugoslav drilling engineer Dragutin Jovanovic, who had first Clifford Wang and then Jack Sell, both civil engineers from the United States, working with him. During the last several years, Rafael Diaz-Diaz was in charge, coming over from Angola. With him are Krishna Tewari, originally District Engineer in Pokhara, Central Nepal, later with UNICEF in Bangladesh and Wouter Lincklaen Arriens (Netherlands).

The rapid down-the-hole drilling methods and the India Mark-II handpumps were introduced by Rupert Talbot, who spent some years in Sri Lanka, before returning to India. After him, the Swedish drilling engineer Sören Persson took over. He developed a variant of PVC (plastic) down-hole components for the Mark-II handpump. Possibly it still was not the ideal VLOM pump, but showed an interesting way towards a technical solution.

Some of the work in Kalutara was hampered by the high iron content in many of the wells. Although not detrimental to human health, the high iron content would clog the pipes with incrustations and discolour laundry. More so, it would cause the villagers to go back to their traditional, contaminated water sources. Consequently, and with some success, very simple aeration cum filtration plants in the form of fibreglass boxes filled with gravel and sand, would retain the worst iron contamination.

The most interesting part of the Sri Lanka activities was the intense community participation components with an enthusiastic input from the local district government. It is a matter of integrated programming which has PHC and CSDR measures high on the list of priorities. The UNICEF consultant for social approaches for many years, G. L. De Silva, played a major role in keeping all the different sectors and government agencies together. He also was very material in another project of the 1980s, that of sanitation in some of the low-income areas of Colombo, another inroad of UNICEF into the vast problems of the peri-urban areas.

Pacific Islands

The small size of the Pacific island countries and the amount of assistance to them from bilateral and other sources made the UNICEF contributions to water and sanitation continue on a low level. Technical assistance was provided from other organizations, such as ADAB, the Australian Development Assistance Bureau, and WHO with the assistance of their specialists, such as the Sanitarian Joseph Hazbun on the Solomon Islands.

Among the countries supplied with materials and equipment were Kiribati and Tokelau. A new larger project country is Papua New Guinea, with its tribal people in the wooded mountains taking an immense step from neolithic to modern society.

Americas - Urban urgency

Through 1985, the Americas in absolute terms continued to receive the smallest share of UNICEF assistance of all the regions. The continued needs in the face of the growth of most of the populations and political pressures reflecting the great social and economic discrepancies made UNICEF, with small funds, try to uphold and improve its inputs.

One salient feature was the acceleration of the growth of the cities, illustrated by the oft-quoted figures from Mexico City which had grown from four million inhabitants in 1960 to over 20 million in the Distrito Federal in 1985. Assistance in the form of self-help for peri-urban communities continued throughout the period and increasingly was provided with a strong health education element, linked with CSDR.

In four coastal cities in Mexico, campaigns were launched with the assistance of UNICEF Programme Officer Enrico Orofino (now stationed in Ouagadougou), to help slum dwellers built latrines, not an easy task as the location of their dwellings forcibly had been kept in low-lying marshlands close to river estuaries which frequently were flooding homes and streets. In the programme for the "pueblos jovenes" of the "barriadas" of Lima, Peru, aid was given with designs, tools and materials to construct simple water supply, shower and laundry facilities, along with latrines. Specific problems could arise, such as the need to provide household water directly to the urban populations without prejudicing the projects by antagonizing the private water vendors. These could hold virtual monopolies on the water trade and charge exorbitant prices to the local people. This problem arose recently for UNICEF's programme staff while planning for UNICEF support to the peri-urban areas of Guayaquil, Ecuador, and is presently being studied.

The rural water supply activities with UNICEF assistance continued in the Caribbean. In Haiti, the Belgian UNICEF Programme Officer, Raymond Janssens, previously responsible for co-ordinating the handpump activities in India, managed to give a major boost to a new water well cum handpump programme, introducing the India Mark-II pump to the Americas, where previously cast-iron pumps of traditional designs had been predominant. During the last years in Haiti, this task was greatly

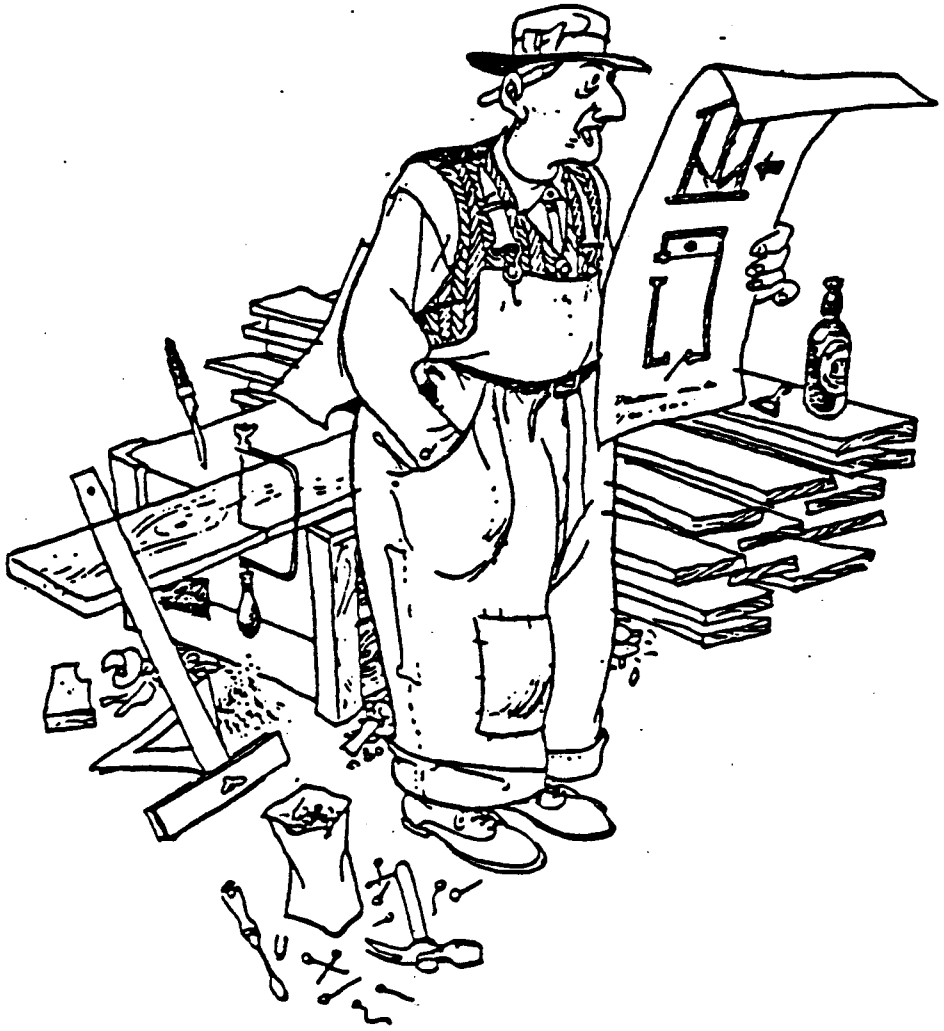
helped though the dedicated professional management of the Director of the National Society for Drinking Water, engineer Pierre Sajous. The most recent political changes with the end of the 28 years of rule by the Duvalier family may bring about a further and much-needed increase in activities. A stepping-up of activities was also being prepared in Guyana.

In Mexico, water supply and rural areas went on, albeit on a low level of expenditure. In the Sierra Madre de Chiapas, the mountain range bordering on the Pacific Coast in the southern part of the State of Chiapas, spring protection and gravity feed schemes were built by local teams of engineers and technicians, funded by UNICEF. Likewise, in the Chiapas Highlands, closer to the State Capital, Tuxtla Gutierrez, small amounts of materials for pipelines were provided to women's associations for rural development.

In Central America, after some years of low-key but continuous support to Guatemala, Honduras, El Salvador and Nicaragua, a marked increase in planning for UNICEF-funded water and sanitation activities took place. An entirely new programme for well drilling and handpumps began in 1985 in Belize. By the beginning of 1986 the establishment of an area post for Central America of a joint PAHO/UNICEF water supply and sanitation adviser was seriously being considered.

In Peru the support to rural water supply in the Antiplano areas around Puno and Cuzco continued. In Paraguay, the UNICEF support was phased out in early 1985 with the government expressing its great satisfaction over the work done by presenting the Health Ministry's Medal of Merit to UNICEF's outgoing Water Engineer, John Rodolfo Townsend from Chile, who had helped move the programme along since 1977, and the Uruguayan Resident Programme Officer, Enrique Madueño Ucar.

Bolivia also continued to receive materials and equipment on a relatively low level of funding. The employment in 1985 of engineer Pedro Velazquez Barrón from Mexico as Project Officer was a much-needed boost to the programme and is hoped to attract more special contributions.



SANITATION – PLANNING AHEAD

World-renowned Norwegian artist Kjell Aukrust's true-to-life

5. SUMMING-UP AND OUTLOOK FOR THE FUTURE: THE ENVIRONMENT, WATER AND SANITATION IN THE CHILD'S LIFE

Children as the most vulnerable group of human populations are also the ones most dependent on their environment. This influences them both physically and mentally. The effects are direct on themselves, including the provision of adequate water supply and sanitation, as basic services affecting their hygienic and health conditions. The effects are also indirect through the influence on the adults in the children's immediate surroundings. The access to water for domestic uses and sanitation makes a great difference in the quality of life of the adults, especially the mothers. It directly helps to improve their own health as well as that of the infants and children in their charge.

In a wider sense, the environment in terms of entire landscapes and the communities with their immediate surroundings, in its different conditions also directly influences the lives of children in many ways. This includes the ecological and epidemiological state of the environment, as well as their housing conditions. It affects food production, the epidemiological situation, the access to water and the ways in which sanitation can be introduced and maintained at satisfactory levels. It should be noted that water supply and sanitation cannot be singled out as panaceas, but have to be regarded as integrated parts of the necessary health background of children.

In the most seriously affected areas of the world, where much if not most of UNICEF's inputs are applied, the deterioration of the environment is progressing at an ever-accelerating rate. This not only affects children and adults alike, but it causes a gradual depletion of forests and other vegetation, the underlying soils and water resources.

The resulting loss of agricultural production and of other means to sustain a reasonable quality of life, including the supply of water and household fuel, tend to increase child and infant mortality and morbidity rates. There are many cases of large-scale migrations to what are assumed to be greener pastures, in a literary or in a symbolic sense. Such migrations take place inexorably not only in emergency situations such as the present one in Africa, but are the result of a long-drawn, seemingly irreversible process in many other parts of the world.

Entire villages with their formerly cultivated lands on the slopes of the Himalayas in Pakistan, Nepal, northernmost India, are carried down into the valleys, forcing thousands of people to settle in already overpopulated areas of the lowlands. In Mexico, a general drying out of the soils and also, in mountainous areas, of deeper groundwater resources jointly with damaging traditional planting practices, are destroying entire landscapes. UNICEF-assisted projects in the Sierra Madre de Chiapas, carried out during the last few years, risk to be laid waste in another few years through this phenomenon, causing a wholesale migration of entire communities in the higher mountain levels to especially Mexico City. The population figure of this city already has reached beyond the limit of what could be deemed acceptable in the limited space between the

volanoes and mountain ranges - where toxic fumes from big industries and millions of through air pollution cars create yet another health hazard for children and grown-ups alike.

The impact of all this on children's lives and well-being is evident and would be noted in any planning concerning the improvement of their condition. The actions to improve basic services, such as water supply and sanitation as well as other environmental conditions like vector control, have developed technically over the last forty years and, even more importantly, been given a different priority by most governments and the external organizations supporting their work.

Human conflict, which caused much of the destruction or lowering of the quality of life as a consequence of the Second World War in large areas of the world, had its direct impact on all of the basic services concerned. The rehabilitation of war-damaged water supply and sanitation systems immediately after the end of that war, primarily was concerned with municipal systems in the industrially more developed countries. There the skills and the experiences were more easily available than in the then predominantly colonial areas and territories, where water, sanitation and other environmental preventive measures were largely still rather rudimentary.

The independence of the former colonies, the gradual development of their own administrations and human capacities, combined with the development of external co-operation, did slowly lead to a better recognition of the needs for basic services. Although it is still incomplete and in some parts of the world interrupted by new bouts of human conflict, largely this development process, helped by great scientific, technical, industrial and conceptual advances, seems to be spreading with positive benefits. The problem now, especially in the fields of water supply and sanitation, which require a global awareness and participation by the communities concerned along with major investments, is to help promote the coverage of entire populations in spite of the rapid increase in their numbers.

The health factors - new insights

Determining the effects of water supply, sanitation and other environmental factors on the health, and consequently of social and economic conditions of the communities, and in particular of children, during the past four decades has become much more complex. Biomedical, epidemiological, immunological, nutrition and other scientific research, combined with social sciences and technical developments have provided insights, particularly during the last twenty years, which make it possible now to plan more purposefully for preventive and remedial action.

This has lead to the realization that the interrelationships between the different health factors, between human hosts and pathogens, between infectious diseases, particularly diarrhoeal diseases, and malnutrition,

and between those components and possible preventive measures are intensely intricate and have to be analysed in much greater detail in order to provide a really effective basis for any planning.

For the biomedical field, the whole array of biochemical, genetical and other microbiological methods and insights of the last twenty years, has contributed to a completely different set of knowledge of the pathogens, their identification and ethiology as well as the immunology connected with them. The intensification and systematization of field studies, supplemented by laboratory work, often in the field study areas themselves, have lead to a considerable re-appreciation of the cause-effect relationships in terms of the health effects of water and sanitation, particularly as related to diarrhoeal diseases.

This in its turn has greatly stimulated the present integrated approaches to improvements in the health conditions of children and the communities they live in. It has helped towards a better combination of preventive and curative measures, including improved vector control, immunization and new drugs (e.g. against schistosomiasis) in combination with the provision of safe water and sanitation facilities. The need for water supply in adequate quantities - not only better quality - has been further recognized in its effects on personal hygiene with a direct impact on other categories of diseases, notably skin and eye infections.

The equally important health effects through easier access to household water by installing water points in the domiciles or their immediate proximity, directly benefit the women and older children, through the shortening of the long hauls of water from distant sources. Recent research tangibly shows the expenditure of energy and consequently the impact on mother and child health through the traditional carrying of water. Daily time savings through water close to the homes in some regions of the world may amount to many hours, and in terms of energy to hundreds of joules, better spent on breastfeeding infants, participating in more productive work, dedicating time to the household and the children, on the education of the women themselves - or even on rest and rehabilitation.

Yet another health factor through adequate provision and management of water supply and sanitation, lies in the use, wherever the access to water resources so allows, of excess water quantities from pumps or gravity feed schemes for micro-irrigation. This is applied to the growing of nutritious vegetables and fruits, improving especially child nutrition and family economy. A notable example of micro-irrigation on a large scale, improving the rural economy, and originating from village water supply schemes with the use of handpumps, is the Manually Operated Shallow Tubewell Programme in Bangladesh. Indirect as the effects of this may be on children's health, it nevertheless represents an advance in economy and food supply to their families, achieved with a minimum of cost.

The remedies: A revolution in technologies and social awareness

The past forty years have witnessed great changes in the awareness of the basic needs of the poorest populations and in the approaches to solve the connected problems. These changes are the result of a trial and error process both in terms of concepts, technologies, planning and programming. The need for supporting the poorest areas both in rural and peri-urban settings, prompted a departure from the conventional, strongly urban-oriented approaches. This required a better understanding and stronger political commitments from the side of the governments in the developing countries. It also implied a more holistic approach on the side of the international, bilateral and other agencies. A great role in properly developing and utilizing the experiences was and continues to be played by the non-governmental organisations.

Lower-cost technologies

Thus, the overall trend especially during the last fifteen to twenty years has led to lower-cost technologies and the development of projects and their implementation on a community basis. On the technological side, this has been made possible through new materials and machinery. Surface waters, generally being contaminated and anyway not easily accessible on a year-round basis, are usable only for major urban agglomerations, where water treatment plants can be operated and where water distribution networks really serving the entire population can be installed. That is feasible only for one-fifth of the entire population of the world. Thus, the water resource to develop is groundwater. Even this type of water resource may have its physical and quality limits in certain regions in the world, but it is the only one that can be tapped at reasonably low cost. (Some of the lowest cost handpump installations, e.g. in Bangladesh, can be carried out for as low as US $ 2 per capita. US $ 25 per capita is a normal figure for deeper handpump installations in borewells or for piped gravity feed schemes with public standposts. This compares well with costs for high-technology water installations, ranging from US $ 300 to thousands of dollars per capita.)

The use of high-speed water well drill rigs has made it possible to sink 50 metre wells (150 feet) in hard rocks in one eight-hour shift, as against one to four months with traditional equipment. The handpump types of yesteryear had to be redesigned radically in order for each pump to effectively serve hundreds of villagers daily. The combination of such technologies is now bringing water supply to another estimated 45 million people in India each year. New sophisticated filter media with strong germicidal properties hold certain potentials to further improve water quality. The lowering of costs for solar energy will contribute to provide an easier flow of groundwater to remote communities. Subsurface dams are increasingly coming to use in tropical and subtropical regions, where the waters in open dams disappear too rapidly through extreme evaporation rates. This improvement of technologies is going on all the time and is now more purposefully directed to applications in the poverty areas.

Similarly, sanitation technologies have been developed towards low-cost options with the use of local materials and locally acceptable designs. This pertains especially to excreta disposal. Installations such as the "VIP" (Ventilated Improved Pit) latrines are getting increasingly widely spread and contribute to lower the risk of infections via the fecal-oral route. Recycling of wastes and the composting of fecal matter for the production of fertilizer and biogas may not yet have won universal spread but are practiced in a number of countries with a direct economic and sanitary impact on the local populations.

Social approaches

The once completely mechanical approach to providing water supply and sanitation to communities had to be completely overhauled, in order to allow the installations to be used to full advantage. The old "top-down" type of programming and project implementation left in its wake thousands of costly and installations, unusable in the form of derelict water treatment plants and broken handpumps, leaving the communities in the same or worse sanitary conditions as before.

The same pertained to the scant efforts to promote environmental sanitation, a subject even less enticing to the sense of the communities for their own improvement. A full realization of the need for community participation, combined with the appropriate motivation and education, came about generally only during the 1970s. This concerns any type of activity, but is particularly noticeable in the improvement of the very basic services of water supply and sanitation, which require concerted agreement and action on the side of the inhabitants who stand to benefit.

In this context, the particular place and importance of women in society plays a most important role. Not only are they the traditional providers of water or "managers" of their own households, but they are the educators of especially the infants and the young children as well as of the older girls. As a major, but little or badly used, human resource of the communities themselves, with the provision of adequate water supply and sanitation facilities, women in hundreds of thousands of communities all over the world have a tremendous potential, if they are allowed to use their participation as an entry point towards gaining a higher level of prestige, effectiveness and fulfillment of their own lives. We are presently only witnessing the first beginnings of this process, but they are promising. The first inroads are being made to develop women's social standing and chances for advancement in traditional male strongholds, such as parts of rural northern Pakistan, through the training and introduction of woman village sanitation promotors. In Ethiopia, the surprising strength of the new women's associations in the villages, will be further supported through easier access to water.

Human Resources Development

A further step on the road to this improvement is the recently intensified action for Human Resources Development. This includes training of people at all levels - government, technical support staff, social workers and mainly in the communities themselves. The insufficient skills and their uneven distribution are still the main bottleneck in any development. Again, major steps are being taken to overcome this with the promotion of policies - not an easy thing in view of the needs for more adequate budget resources and for wide-ranging administrative and financial improvement.

Nevertheless, there are serious efforts to advance this part of the work on a country basis with active participation on the side of the international community. There is a conscious development of training methodologies, curricula and materials, jointly with stronger support to regional and national institutions, training centres and the like. This human resources development furthest out in the communities, again increasingly contains elements of health and sanitation education, largely directed towards the children.

At this stage there are no data available as to the state of awareness or education among children in the different parts of the world, in terms of water use, sanitation and health. In all likelihood, the last forty years in many major countries would have signified great changes, particularly where the means of communications would have improved with the use of satellite-based television and other media for educational purposes, or just through more widely spread basic education.

Finance and administration

The funding and administrative capacities needed for bringing about the vast investments needed for the equally vast improvements in the lives of millions of families and their children, are still insufficient with more than half of the needs not covered at this stage. Yet, there are improvements. Communities seem more willing and interested to contribute their share to the financing and upkeep of facilities. Governments in the developing countries now have national plans, where there were none before, with the corresponding budget lines. Administrations are better geared in many countries to support the work.

All the new insights and the increase in activities with the ensuing complexity in terms of planning and management, also have led to the increased use of evaluations to lay the ground for more efficient monitoring and management of programmes and projects. The systematic use of these new techniques and methodologies for evaluations are still under development. Particularly the ultimate effects on the health and lives of children will take a long time to properly estimate and evaluate.

International Action and UNICEF's Role

Far from being complete or ideal, the situation as to institutions in the individual countries and their share in the work to improve the situation, seem positively different from the situation in 1946. Then a world, physically and economically in shambles after a devastating World War, and with the emergence of a great number of new countries out of the artificial and arbitrary subdivisions of the old colonial empires, had to take its time to get organized. The fields of water supply and sanitation, tangible as they are, by the last ten years have advanced more than anybody might have anticipated even around 1970. It is as yet several generations too early to see, what effect this development will have on the lives of adults and children alike, but there is at least some effect.

Without being unduly optimistic, this development is being aided by an unusually concerted and politically non-controversial action between the different countries in the world, supported by the International Drinking Water Supply and Sanitation Decade 1981-1990. This is a promotional measure under the aegis of the United Nations, agreed upon by the Member States and actively pursued by them.

As it seems, considerable part of the present trend towards improvements in water supply and sanitation in the majority of the developing countries, is due to this promotional activity. It is not a programme in itself, and its goals to achieve the provision of water supply and sanitation to everybody by the year 1990 may remain unfulfilled in many countries, but at least a beginning has been made.

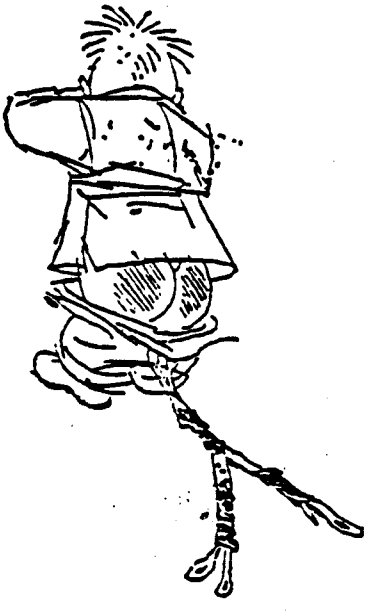
The role of UNICEF is impossible to properly assess, since this organization is involved in such close co-operation and - particularly with the Water Decade - co-ordination with government, international and other agencies - hundreds of them - that it is difficult to state, where the work of one agency begins and the other ends. UNICEF:s concern for the poorest segments of the rural and peri-urban populations and consequently the active promotion towards governments to formulate policies, to set the corresponding priorities and to implement the programmes and projects accordingly, certainly has contributed to a more rapid coverage of the populations on a national scale in many countries. The effective co-operation with a number of major international organizations, notably WHO, UNDP, UNTCD and the World Bank, has developed into what probably is one of the best United Nations support actions any time in a specialized field.

Outlook

The dependance of children on their physical environment and basic services related to this, during the last fifteen-twenty years has been crassly, tragically illustrated through the enormous ecological catastrophes, on a large scale in Africa, on only somewhat smaller and slower scales in parts of Asia and the Americas. The question of water and sanitation for child health and welfare has to be seen in a wider environmental context.

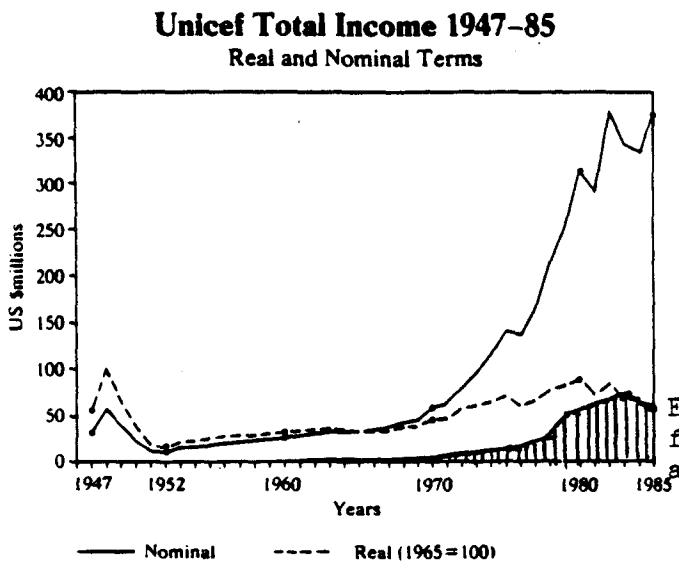
Progress in improving the immediate environment of the child in the developing countries seems positive, although all the time on the verge of being outbalanced by the still rapid population increase in large parts of the world. The greatest uncertainty is in the deteriorating environment, caught in the cycle of overpopulation, deforestation, overgrazing, overcultivation, erosion, desiccation and desertification.

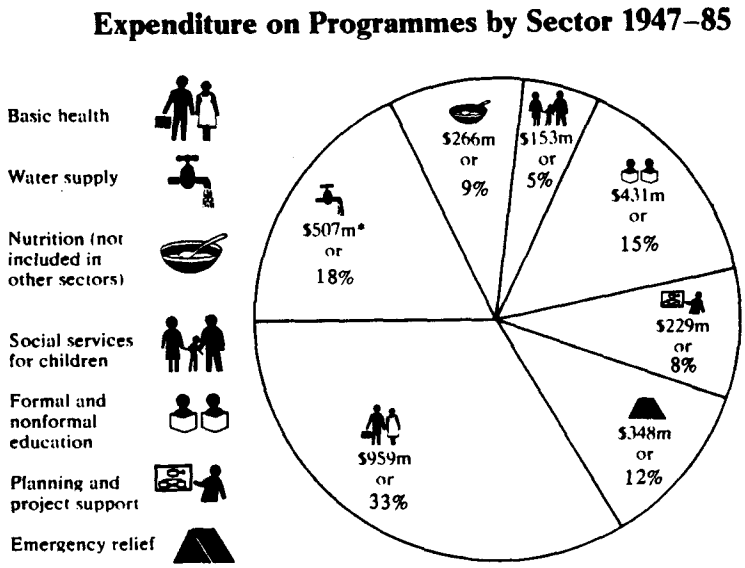
The next large step to overcome is that of increasing the awareness of the environment. For this, a motivational and educational effort of unprecedented and complicated dimensions is overdue. This will have to be directed to adults and children alike and be accompanied by direct practical measures, involving agricultural extension and all phases of community development. After all, the children of today face an environmental heritage even more depleted than it was forty years ago.



THE END

6. The WET Statistics





* Expenditure for water supply incurred prior to 1970 is included in basic health.

Unicef Expenditure from Inception through 1985 ($ million)

	1947–50	1951–59	1960–69	1970–79	1980–85	1947–85
Long-range aid:						
Health services	8.0	26.0	97.7	313.8	362.0	807.5
Mass disease control campaigns	12.3	56.7	82.2	*	*	151.2
Water and sanitation	*	*	*	156.3	350.8	507.1
Child nutrition	5.4	19.1	47.3	87.0	107.7	266.5
Social welfare services for children	*	*	9.1	49.3	94.9	153.8
Formal education	–	–	30.3	170.9	141.1	342.3
Nonformal education	–	–	2.4	27.7	58.2	88.3
General**	–	–	6.3	62.3	160.4	229.0
Total long-range aid	25.7	101.8	275.3	867.3	1 275.1	2 545.2
Emergency relief***	82.3	34.8	11.1	42.7	177.2	348.1
Total programme aid	108.0	136.6	286.4	910.0	1 452.3	2 893.3
Programme support services	0.3	14.1	42.4	158.1	293.6	508.5
Total assistance	108.3	150.7	328.8	1 068.1	1 745.9	3 401.8
Administrative costs	6.6	10.6	25.5	97.9	216.6	357.2
Total expenditures	114.9	161.3	354.3	1 166.0	1 962.5	3 759.0

* Included in health services.

** This assistance cannot be broken down into the above categories. It includes mainly planning and project preparation, project support services and project support communication.

*** Not including expenditure for rehabilitation of facilities damaged or destroyed in emergency situations which is distributed into appropriate categories of assistance. Emergency relief and rehabilitation combined would be $168 million during 1970–1979 and $279 million during 1980–1985.

One Year of UNICEF Co-operation for Water Supply and Sanitation: 1985

COUNTRY	EXPENDITURE (in US $)	BENEFICIARIES	
		Water Supply	Sanitation
West Africa			
Angola	1,032,000	52,000	1,000
Benin	587,000		
Burkina Faso	744,000	200,000	400,000
Cameroon	-	29,000	
Cape Verde	14,000		
Central African Rep.	493,000		
Chad	205,000		500
Gambia	176,000		
Ghana	461,000		
Guinea	265,000	68,000	
Guinea-Bissau	450,000		
Liberia	51,000	87,000	7,000
Mali	553,000		
Mauritania	14,000	3,000	
Niger	576,000	78,000	73,000
Nigeria	2,471,000	300,000	21,000
Senegal	38,000	6,000	
Sierra Leone	87,000	80,000	2,000
Togo	3,000		
Zaire	712,000	100,000	
East Africa			
Botawana	47,000		
Burundi	426,000		
Comoros	7,000		
Djibouti	587,000		
Ethiopia	2,236,000	437,000	70,000
Kenya	133,000		
Lesotho	80,000		
Madagascar	87,000		
Malawi	46,000	50,000	7,000
Mozambique	396,000	191,000	4,000
Rwanda	202,000		
Somalia	451,000	65,000	3,000
Uganda	3,579,000	523,000	
United Rep. Tanzania	646,000	335,000	40,000
Zimbabwe	94,000	47,000	24,000

One Year of UNICEF Co-operation for Water Supply and Sanitation: 1985

COUNTRY	EXPENDITURE (in US $)	BENEFICIARIES	
		Water Supply	Sanitation
Middle East and North Africa			
Democratic Yemen	44,000	82,000 (1984)	3,000 (1984)
Egypt	2,018,000	40,000+	5,000
Jordon	15,000		
Lebanon	2,418,000	89,000	
Morocco	257,000	119,000	
Oman			30,000
Sudan	1,687,000	185,000	4,000
Tunisia	281,000		
Yemen Arab Republic	164,000	27,000	90,000
Americas			
Argentina	26,000		
Belize	347,000		
Bolivia	517,000	22,000	20,000
Colombia	300	32,000	5,000
Costa Rica	38,000		
Cuba	43,000	37,000	
Dominica			4,000
Dominican Republic	14,000	8,000	14,000
El Salvador	700		
Guatemala	338,000		
Guayana		3,000	
Haiti	324,000	87,000	5,000
Honduras	300		
Jamaica	11,000		
Mexico	168,000	31,000	
Nicaragua	337,000		
Panama	16,000		
Paraguay	42,000		
Peru	87,000	82,000	55,000
Other Caribbean	47,000	4,000	
Regional Urban	334,000		

One Year of UNICEF Co-operation for Water Supply and Sanitation: 1985

COUNTRY	EXPENDITURE (in US $)	BENEFICIARIES	
		Water Supply	Sanitation
South Central Asia			
Afghanistan	33,000	141,000	31,000
Bhutan	266,000		
India	9,410,000	3,473,000	538,000
Maldives	87,000	396,000	
Nepal	2,008,000	243,000	30,000
Sri Lanka	744,000	167,000	99,000
East Asia & Pacific			
Bangladesh	1,929,000	6,680,000	437,000
Burma	2,686,000	402,000	950,000
Indonesia	1,512,000	172,000	4,000
Kampuchea	469,000	5,000	
Lao P.D.R.	322,000		17,000
Pakistan	4,561,000	1,109,000	107,000
Papua New Guinea	29,000		
Philippines	351,000	29,000	4,000
Solomon and other Pacific Islands	81,000		
Thailand	1,140,000	95,000	25,000
Vietnam	1,166,000	433,000	

7. ABBREVIATIONS

ADAD	Australian Development Assistance Bureau
AFESD	Arab Fund for Economic and Social Development (Kuwait)
AFPRO	Action for Food Programme (India)
AGFUND	Arab Gulf States Fund (Riyadh)
AMD	Agricultural Mechanisation Department
AHWG	Ad Hoc Working Group for Rural Water Supply (OECD/UN)
AIT	Asia Institute of Technology (Bangkok)
BIAD	Baluchistan Integrated Area Development (Pakistan)
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit (Federal German Ministry for Economic Co-operation)
CEAD	Craelius East African Drilling Company
CEFIGRE	Centre de la Formation Internationale pour la Gestion des Ressources en Eau (France)
CEPIS	Centro Panamericano de Ingeniería y Ciencias del Ambiente (WHO/PAHO, Lima)
CETESB	Centro Tecnico da Engenheiría Sanitaría do Brasil (Sao Paulo)
CIDA	Canadian International Development Agency
CIEH	Centre Inter-African des Etudes Hydrauliques (Ouagadougou)
CILSS	Comité Inter-Etats pour la Lutte contre la Sécheresse au Sahel
CRS	Catholic Relief Services
CSDR	Child Survival and Development Revolution
DAC	Development Assistance Co-operation
DANDO	Duke and Ockenden (UK)
DANIDA	Danish International Development Agency
DTCD	Department for Technical Co-operation for Development (UN)
ECA	Economic Commission for Africa (UN/Addis Ababa)
ECE	Economic Commission for Europe (UN/Geneva)
ECLA	Economic Commission for Latin America (UN/Santiago/Mexico City)
ECOSOC	Economic and Social Council (UN)
ECWA	Economic Commission for Western Asia (UN/Baghdad)
EROS	Earth Resources Observation Systems (USA)
ESCAP	Economic and Social Commission for Asia and the Pacific (UN/Bangkok)
EWRA	Ethiopian Water Resources Agency
FAO	Food and Agriculture Organization (UN/Rome)

GOBI	Growth Monitoring, Oral Rehydration, Breastfeeding, Immunization.
GTZ	Gesellschaft für Technische Zusammenarbeit (German Technical Co-operation Corporation)
HDP	High Density Polyethylene (plastic)
HRD	Human Resources Development
ICAO	Interational Civil Aviation Organization (UN)
IDA	International Development Association
IDB	Inter-American Development Bank
IDRC	International Development Research Centre (Canada)
IDWSSD	International Drinking Water Supply and Sanitation Decade 1981 - 1990
ILO	International Labour Organization (UN/Geneva)
IMCO	Inter-Governmental Maritime Consultative Organization (UN/London)
INSTRAW	Institute for Studies, Research and Training for the Advancement of Women (UN/Santo Domingo)
IRC	International Reference Centre for Community Water Supply and Sanitation (The Hague)
IRC/CWS	see IRC
IRCWD	International Reference Centre for Waste Disposal (Dübendorf/Switzerland)
JCHP	Joint WHO/UNICEF Committee on Health Policies
JNSP	Joint UNICEF/WHO Nutrition Support Programme
JOICFP	Japanese Organization for International Co-operation in Family Planning
MERADO	Mechnical Engineering Research and Development Organization (India)
MOSTI	Manually Operated Shallow Tubewell Irrigation (Bangladesh)
NASA	National Aeronautic and Space Administration (USA)
NEERI	National Environmental Engineering Research Institute (Nagpur/India)
NGO	Non-governmental organization
ODA	Overseas Development Agency (UK)
OECD	Organization for Economic Co-operation and Development
OFEDES	Office pour L'Exploitation des Eaux Souterraines (Niger)
OPEC	Organization of Petroleum Exporting Countries

PAHO	Pan American Health Organization (WHO/Washington, D. C.)
PASB	Pan American Sanitary Bureau (PAHO)
PEPAS	Western Pacific Regional Centre for the Promotion of Environmental Planning and Applied Studies. (WHO/Kuala Lumpur)
PFO	Programme Funding Office (UNICEF)
PHC	Primary Health Care
PRODESCH	Programa para el Desarrollo de los Altos de Chiapas (Mexico)
PVC	Polyvinylchloride (plastic)
RWSD	Rural Water Supply Division (Burma)
SATA	Swiss Agency for Technical Assistance
SENASA	Servicio Nacional de la Salud (Paraguay)
SIDA	Swedish International Development Agency
SUDAM	Superintendencia do Desenvolvimiento da Amazonia (Brazil)
SUDENE	Superintendencia do Desenvolvimiento do Nordeste (Brazil)
TAB	Technical Assistance Bureau (UN)
TAG	Technical Advisory Group (UNDP/World Bank)
UCI	Universal Child Immunization
UN	United Nations
UNCDF	United Nations Capital Development Fund (New York)
UNDP	United Nations Development Programme (New York)
UNDTCD	United Nations Department for Technical Co-operation for Development (New York)
UNEP	United Nations Environment Programme (Nairobi)
UNESCO	United Nations Education, Science and Culture Organization (Paris)
UNICEF	United Nations Children's Fund (New York)
UNIDO	United Nations Industrial Development Organization (Vienna)
UNIFIL	United Nations Interim Forces in Lebanon
UNTAB	United Nations Technical Assistance Bureau (now UNDTCD)
USAID	United States Agency for International Development
USOM	United States Official Mission
VIP	Ventilated Improved Pit (latrine)
VLOM	Village Level Operation and Maintenance
WASH	Water and Sanitation for Health (USAID/Washington, D.C.)
WES	Water and Environmental Sanitation
WET	Water and Environmental Sanitation Team (UNICEF)
WFP	World Food Programme (UN/Rome)
WHO	World Health Organization (UN/Geneva)
WMO	World Meteorological Organization (UN/Geneva)

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